OFFICE OF NAVAL RESEARCH

BRANCH OFFICE — LONDON, ENGLAND

TECHNICAL REPORT
ONRL-35-66

NOTES ON PSYCHOLOGICAL TRAINING AND RESEARCH IN YUGOSLAVIA:

PSYCHOLOGICAL INSTITUTE, UNIVERSITY OF ZAGREB AND THE INSTITUTE FOR MEDICAL RESEARCH AND INDUSTRIAL HYGIENE, ZAGREB

BY

JOHN E. RASMUSSEN

6 August 1966

NOTES ON PSYCHOLOGICAL TRAINING AND RESEARCH IN YUGOSLAVIA
PSYCHOLOGICAL INSTITUTE, UNIVERSITY OF ZAGREB AND THE INSTITUTE FOR MEDICAL RESEARCH AND INDUSTRIAL HYGIENE, ZAGREB

Yugoslavia is comprised of at least five major, separate and distinct cultural groups (as well as a number of smaller groups) united into a single political state. The differences among these cultures would appear to be more pronounced than the similarities in several areas such as language, standard of living, education, literacy, art, and literature. The geography ranges from semi-arid land to magnificent beach resorts and from fertile farmlands to a beautiful alpine lake region.

A train trip through the length of Yugoslavia serves to highlight these differences. Watching the swarthy peasants of Macedonia till the fields with oxen and wooden ploughs, one is led to wonder how much this particular culture has evolved since the time of Christ. On the other hand, Belgrade, Zagreb, and Ljubljana have both business and residential areas which differ little from those found in other cities throughout Europe. Zagreb, particularly, is a center of music, art, science and university life. One cannot help being impressed with the amount of building which is underway and the contrast of the old and the new ultra-modern structures.

Mechanization and partial industrialization have made a major impact upon Yugoslavia during the post-World War II period. In fact, this country constitutes an excellent example of the realistic problems engendered when changes are made in the mores, value system and living habits of deeply-rooted and traditional cultures. For example, the major Yugoslav airline flies Caravelle jets on its international routes; however, reserving a seat is a major undertaking. All reservations are controlled from Belgrade, and an effective system has not as yet been developed for making and confirming reservations. On occasion, all Yugoslav airline flights have been cancelled for a national holiday; but, unfortunately, this information may not be disseminated until immediately prior to the holiday. There are new telephone booths, but many of the phones don't work. Nowhere is the clash between ancient culture and industrialization more apparent than in the public market, where the beatnik with his guitar rubs shoulders with peasants in their age-old traditional costumes who are

attempting to sell containers of rich country dirt to the city dwellers. These examples may be either amusing or irritating, depending on one's frustration tolerance; nevertheless, they are reflections of the difficulties and growing pains which are created by the drastic changes now occurring in the Yugoslavian way of life.

During the International Congress of Applied Psychology in Ljubljana two years ago, the Yugoslav Government reduced customs and immigration formalities almost to the point of nonexistence. Special arrangements to ensure adequate hotel accommodations and transportation for Congress participants were made. Certainly there was no attempt in any way to control, restrict, or hamper the movement and activity of the foreign participants. The Yugoslav psychologists one met at this meeting tended to be open, friendly, and unguarded. Many foreign psychologists attending this meeting expressed surprise at how much the general atmosphere of the country and the behavior of the people differed from what they had anticipated would be an "Iron Curtain" country. However, most persons also had a rather unclear or vague concept of what they might expect. In any event, most of the Yugoslav psychologists present were so occupied with the activities related to management of the Congress that the majority of foreigners obtained only a limited feeling for Yugoslavian psychology. Accordingly, a return visit could be anticipated with some interest.

Generally speaking, the picture had changed little between the time of the Congress and the visit upon which this report is based. The same friendliness and warmth towards foreigners as manifested during the Congress was evident. Again, one had a feeling of total freedom of movement and activity. The Yugoslavs related freely, easily, and opened their homes in genuine gestures of friendship. Domestic and international politics were discussed with the same readiness which was manifested in approaching academic topics. Some persons found a great need to criticize the present political and economic situation in Yugoslavia, and others said little. On the other hand, almost all of the academic people encountered had rather pressing and straightforward questions to ask about the US policy in Vietnam. Probably the most pronounced contrast with the 1964 visit was the marked increase in prices and the apparent economic difficulties and other inflationary problems.

HISTORY OF PSYCHOLOGY IN YUGOSLAVIA

As in most European countries, the roots of Yugoslav psychology are to be found in philosophy. However, the country also is somewhat unique in that Yugoslav psychology has been identified with one name from its founding until the present day -- the name of Bujas. Professor Ramiro Bujas is credited with establishing psychology as a scientific experimental discipline when he created the laboratory of psychology at Zagreb Medical School in 1920. His son, Professor Zoran Bujas, is the commonly acknowledged (and somewhat autocratic) leader of present-day Yugoslav psychology. It is rather difficult to determine which of the two men has had the greater impact on the discipline of psychology in Yugoslavia; certainly, the elder Bujas must be given credit for primary development of the discipline, but one rather suspects that the younger Bujas is responsible for the present day vigor and quality which characterizes psychological training and research -- at least in Zagreb.

Professor Ramiro Bujas, who died in 1959 at the age of 80, initially was trained in philosophy and literature. He developed a keen interest in psychology and psycholinguistics, which persisted through the years. His range of interests extended well beyond psychology -- from the use of hypnosis in childbirth through archeology and the fine arts. In fact, he did considerable research on dating ancient monuments and art works in Yugoslavia. When he was well over 30 years of age, Bujas entered medical school in order to obtain what he believed to be a proper foundation for the more "scientific" study of psychology. In 1920 he established Yugoslavia's first psychology laboratory in the Physiology Department of the Medical School.

Ramiro Bujas also established the only Yugoslavian psychology journal, Acta Instituti Psychologici, which is published by Zagreb University. The majority of Yugoslavian psychological research is published in this journal, which prints articles in English, French, or German, but interestingly enough not in Croatian.

In 1929 a Chair was established in psychology at the medical school, and Ramiro Bujas was appointed as the professor. It is apparent that the strong physiological orientation which still permeates psychology at Zagreb may be traced directly to both of the Bujas. Following World War II, the Department of Psychology was separated from the science faculty, at the insistence of Russia, and

became part of the faculty of philosophy -- a change which many Zagreb psychologists have not yet fully accepted.

A Chair was established at Belgrade University in 1928 and this Department is the largest in Yugoslavia, although probably not as well known as Zagreb. Belgrade is identified with both social psychology and psychometrics. In fact, the first Yugoslav attempt at standardization of the Binet for use with a Serbo-Croate population was undertaken there in the 1930's. While a department has existed at Ljubljana University for some time, it would appear that psychology has never fully developed at this institution.

At present psychological training and research is centered at the three universities mentioned above. Professor Zoran Bujas now holds the Chair at Zagreb and at the same time is temporarily holding the Chair in Ljubljana, commuting between the two universities.

PSYCHOLOGICAL TRAINING AT ZAGREB UNIVERSITY

The Yugoslav educational system is relatively uniform, regardless of discipline, through a level roughly equivalent to the American Bachelor's degree. However, there are considerable differences between the arts, sciences, philosophy, medicine, and technical areas such as engineering, both in graduate training and in degree patterns. Twelve years of education generally is required for university entrance. Medicine is a five- to six-year course, and all other university first-degree programs vary between four to five years.

There are two separate paths to undergraduate degrees in Yugoslavia, which differ primarily in the proportion of time devoted to the major subject. During the first year all students take two major subjects, such as psychology and an elective area, which may be literature, history, geography, education, etc. In addition, courses in logic or philosophy are required. Croatian, and a foreign language, also are required. After the first year examination results have been computed, a student may petition to follow the "single subject" path for the remainder of his undergraduate work. Approval of this request is granted if the student's grades in the first-year subjects are high enough and he has a positive recommendation from his professors. Students who are not successful in their petition will be required to continue along the two-subject path throughout their undergradute work. For the most part, such students will become high school teachers

and very few will go on to graduate work.

The single-course psychology student must complete two years of language study at the university level and two years of philosophy or logic, otherwise his courses will be concentrated on psychology and closely related subjects after the first year. In this way, the Yugoslav psychology student is exposed to roughly the same amount of formal academic training for his first degree as the American PhD receives in his seven years of formal course work. However, the single-subject Yugoslav undergradute receives far less exposure to the liberal arts than his American contemporary.

The psychologist who does not necessarily intend to go into academic work but desires postgraduate training may undertake a major research problem, write an experimentally based dissertation, and receive a PhD. An alternative path of professional advancement is through the university hierarchy. As a first step after appointment as an instructor, a nonexperimental thesis in psychology is required for the rank of docent (assistant professor). With the publication of additional professional papers, an individual may be appointed as a professor extraordinary (associate professor), and ultimately the chairman of the department is entitled to the rank of ordinary professor (full professor). The same relative path may be taken by the nonacademic psychologist as far as the first step. That is, it is possible to acquire the title of "privatdocent," but the title changes to "docent" if a university appointment is received.

Students are admitted to the study of psychology on the basis of intelligence examinations, language examinations, grades, and an interview with faculty members. Roughly 50-60% of applicants are accepted.

The psychology curriculum at Zagreb, which is representative of Yugoslav universities, is as follows:

FIRST YEAR

Statistics - full year. In addition to correlation techniques and Chi-square, parametric statistics are included through analysis of variance. More advanced statistical techniques are taught in later elective courses.

General Psychology - full year. Experimental psychology is included here. During the first semester there are two lectures and one laboratory session (of three - six hours) per week and two lectures with three laboratory

sessions per week during the second semester.

Physics. This course would be comparable to elementary physics courses in American universities. There is a six-hour lecture and laboratory session each week for the year, covering optics, acoustics, electricity, etc.

Electives. A student may take additional subjects during the first year. These probably will be history of psychology, sociology, etc.

SECOND YEAR

General Psychology - full year.

Physiological Basis of Psychology - two hours of lectures and two of laboratory throughout the year.

Educational Psychology - two hours of lectures and two of laboratory throughout the year.

Experimental Psychology Laboratory - six hours per week of training in use of psychological techniques for one semester.

Auxiliary Subjects - One course in social science as well as history of philosophy and logic. (Continued from first year.)

At the end of the second year a student at Zagreb will specialize in either industrial or educational psychology. While a clinical program has been proposed, it has not yet been formally instituted and one receives the feeling that Professor Bujas is not overly concerned with how soon the clinical training starts.

THIRD YEAR

Psychometrics - four hours of lectures and three hours of laboratory per week - full year.

Educational Psychology - two hours of lectures and two of laboratory - full year.

Industrial Psychology - four hours of lectures and four of laboratory in the first semester. Six hours of lectures and four of laboratory during the second semester.

General Psychology - full year.

Psychopathology - full year.

Industrial Majors - Students specializing in industrial psychology also take courses in organization of work, introduction to political economy (which appears to be the only politically tinged course in the whole academic curriculum); and elements of industrial hygiene. The latter course is taught by the medical faculty.

Educational Psychology Majors - Students specializing in educational psychology, in addition to the basic third year courses, have courses in school hygiene (taught by the medical faculty), and introduction to education.

FOURTH YEAR

General Psychology - full year.

Specialized Topics - Each senior student engages in an intensive reading-tutorial course with an individual professor during his fourth year. The course content and direction of the reading is determined by the student's interest, as approved by the faculty. This course usually forms the basis for the thesis research.

Thesis - Each student completes a thesis, based on experimental work, which is roughly equivalent to that required for the Master's degree in the US.

At the end of the fourth year, after the thesis has been formally submitted, the students undertake final diploma examinations. These examinations include all of the subject matter covered during the university course, and are rather analogous to the American PhD comprehensives.

The path to the doctorate in Yugoslavia is essentially the same as that throughout Europe. A student either will remain at the university as an assistant while he undertakes his extensive doctoral research -- which is almost a full-time endeavor -- or he will work as a psychologist in an applied setting and collect his research data "on the job." On the basis of the rather limited sample of doctoral research reviewed during the visit to Zagreb, the quality of dissertations in psychology generally is comparable to those produced at any of the better US universities. It would appear, however, that there may be somewhat less individual supervision of the Yugoslav student during his doctoral work.

PSYCHOLOGY DEPARTMENT AND PSYCHOLOGY INSTITUTE, ZAGREB UNIVERSITY

Teaching is a function of the Department of Psychology in the Faculty of Philosophy, and research activity is a function of the Institute of Psychology. The faculty hold dual appointments. At present, in addition to the professor, there are two associate professors, one docent, four lecturers, five assistant lecturers, and two laboratory demonstrators.

The Psychology Department and Institute occupy reasonably spacious quarters in a new and modern building of the Philosophy Faculty. The shift in faculty affiliation from science to philosophy, and the move to the new quarters in 1963 has been somewhat marred by unexpected difficulties. First, while the Philosophy faculty reportedly has been most hospitable to psychology, some problems have been created by the experimental animals. Initially, the concept of a rat colony in the philosophy building received at least passive intellectual acceptance; however, the philosophers found some difficulty, emotionally, in accepting the associated olfactory and logistic problems of maintaining the animal colony. As if the interdepartmental problems over the animal colony were not sufficient in and of their own right, additional difficulties were engendered two years ago by the major flood which inundated Zagreb. The one-year-old university buildings suffered rather serious damage in this flood, and the Psychology Department lost not only its rat colony but a great deal of associated material and equipment.

Laboratory space and research facilities are quite adequate, if one adds the laboratories of the Institute for Medical Research and Industrial Hygiene. In fact, the laboratory training facilities for students well may be some of the most adequate of any European university. An extremely well-equipped experimental psychology training laboratory has been constructed which is essentially modeled after the one at Harvard University. Here, spacious sound-attenuated cubicles are provided for students to carry out their laboratory exercises. The shelves in the Department library are lined with a moderately adequate selection of late textbooks, and a limited number of journals are available. Reportedly, it is not difficult to obtain money for reference books in Yugoslavian universities, although it is quite difficult to obtain funds for the purchase of journals.

As indicated earlier, psychology at Zagreb is dominated by Professor Zoran Bujas, who is a colorful and interesting study in and of himself. An intense man in his mid-

fifties, Bujas apparently has had no difficulty in retaining the position of leadership in Yugoslav psychology which was held by his father. He received a PhD at Zagreb University and then spent three years at the University of Paris, working under Henri Piéron, a person who has had a deep and lasting influence on Bujas' professional orientation. While many European professors wield the same autocratic influence within their universities as does Bujas, there are few whose influence so widely permeates psychology outside of their immediate departments.

In addition to a high level of research activity, resulting in over 100 publications in the past 30 years, he has been extremely active in other professional endeavors. These include serving as vice-rector and rector of the University of Zagreb, president of various Yugoslav commissions on psychology, president of the Yugoslav Psychological Society and president of the International Association of Applied Psychology.

As a person, Bujas manifests all of the graciousness and stately charm of a true European gentleman. At the same time, it was observed that he can quickly respond with irritability when colleagues suggest a less than adequate solution to a problem or fail to comprehend his instructions. He speaks flawless French and prefers to use this language with foreigners. Bujas is reasonably fluent in English, although as a general rule he chooses not to use this language in superficial contact with his foreign colleagues. It would appear that this attitude stems from the fact that his command of English is not good enough to dwell at length on high level abstractions or on highly technical subjects. He is obviously a proud man who thinks rapidly and speaks with precision; to carry on extended conversations in English proves most frustrating and even embarrassing as he gropes for words to explain what he might consider to be simple concepts. Accordingly, it is not surprising that the logical way out of a difficult situation is to disclaim any knowledge of English.

Bujas is a prolific, almost driven investigator who sets high standards of excellence in his research and demands the same standards of his students. There are a number of senior professors in Europe whose interests cover a very wide range of psychological problems; however, Bujas is one of the few, if not the only person, who is actively engaged in fairly sophisticated research in several different problem areas. For a number of years he has been active in the area of psychophysics, psychophysiology of work, and

psychometrics; and he is actively engaged in all three research areas at the present time. Occasionally he works on problems out of his three primary areas of interest and competence. When critically examined, however, his work in such fringe areas appears to be less sophisticated and rigorous than might be expected.

While the bulk of Bujas research is undertaken at the Institute of Medical Research and Industrial Hygiene, for a number of years he has worked on psychometric problems at the Psychology Institute. Of particular concern and continuing interest to him has been the general area of intelligence testing. Bujas is critical of much past as well as contemporary research in this area, both from a philosophical and a psychometric standpoint. First, he believes too much emphasis is placed on finding the "best" or most logical solution to problems in the construction of intelligence tests -- as the best solution may not necessarily be the most realistic or adequate under the circumstances. Thus, for Bujas, the assessment of intelligence involves more than finding "the" correct solution to problems; it requires an evaluation of both the individual's recognition of or sensitivity to problems and his ability to select meaningfully from among the various alternative solutions which may be available. In essence, one might say that Bujas is concerned with the measurement of the ability to utilize intellectual capacity as well as with the native capacity per se. His position with regard to the psychometrics of intelligence testing follows logically from his philosophical criticisms. Thus, he advocates a scoring system which takes into account qualitative variations of response as being fundamental in any effort to assess intelligence.

At present Bujas is engaged in the development of a multidimensional intelligence test which meets both his philosophical and his psychometric criteria of an adequate measurement technique. Work on this test is reasonably well advanced, and several preliminary validation studies have been completed, including a factor analysis of the existing battery which yielded a "G" factor of 0.94. Inasmuch as none of this work has been published, only a broad outline of Bujas' approach will be presented here.

The battery involves approximately a half-dozen subtests, all of which are of either a verbal or symbolic problem-solving nature. In many respects, this battery might appropriately be considered a test of creativity. Throughout the tests there is an emphasis on evaluating

ability to change set in approaching problems or flexibility of intellectual functioning which appears to be weighted as heavily, if not heavier, than factual correctness or incorrectness of answers. In addition to the subtests being designed so that various alternative responses are elicited, several require a ranking of the relative adequacy of the alternative solutions. Three of the subtests are quite unique and different from previously published material of this nature. The remainder have been evolved from more conventional tests.

Bujas' interest in measurement of intelligence, achievement, and personality is quite sharply focused on theoretical and methodological problems. Once the work proceeds to the stage of routine test development and validation, it is quickly delegated to others. Thus, the routine item analysis and validation of the test described above is now being carried out by students.

Next to Bujas, Dr. Borislav Petz is the most active investigator at the Institute of Psychology. Petz trained under Bujas although he also had a period of postgraduate study in England. He now holds an appointment equivalent to Associate Professor at Zagreb University and is responsible for the industrial psychology program. From discussions with Petz, it is obvious that he plays a major part in determining the psychology curriculum and in dealing with departmental administration.

While industrial psychology at Zagreb includes personnel selection, training, and studies of worker motivation, etc., the primary emphasis is in the area of psychophysiology of work. Moreover, the research in this latter area would appear to be far more sophisticated and methodologically sound. The majority of Petz' work has been done in collaboration with Bujas, and almost all has been published in Yugoslavian journals. Earlier in his career Petz worked on the development of a series of intelligence tests, but his later research has been in the area of fatigue. After early studies on decrement of intellectual functioning under conditions of fatigue and nonfatigue, he has gone on to studies of the relationship between muscular fatigue and performance effectiveness. Most of his investigations have been concerned with the static work situation, and include studies of endurance and recovery in repeated performance, the relation of oxygen consumption and static work, and the influence of psychopharmacological agents on performance.

Dr. A. Krković, who holds an academic rank equivalent to Assistant Professor, took his PhD under Bujas and spent a postdoctoral year at Western Reserve University. Like Petz, Krković speaks excellent English and was most interested in discussing Yugoslav psychology. Krković is responsible for the teaching of psychometrics in the Psychology Department, but his primary research interests are in the areas of activation theory, sleep, and vigilance. As is the case with the majority of the faculty members, most of the Krković's research is a team effort.

Probably the most impressive single individual at Zagreb in terms of present accomplishment and future potential is Dr. Norman Sartorius, a psychiatrist who recently completed his PhD training in psychology under Bujas. Sartorius, who holds a permanent appointment in psychiatry in the Zagreb teaching hospital, now is on a British Medical Research Council postdoctoral fellowship in psychopharmacology at the Maudsley Hospital. He is one of three psychiatrists in Yugoslavia who also has completed the full psychology curriculum through the PhD. Moreover, while still in his early thirties, he has published some 20 papers.

Sartorius has two primary research interests, schizophrenic thought disorder and psychopharmacology. His most recent work in schizophrenia was the research which he submitted for his as yet unpublished doctoral dissertation. Basically, this was an experimental approach to the question of whether schizophrenic thought process is best characterized as over-inclusive or as overly-concrete.

Fifty matched pairs of subjects provided a normal control and an experimental group. The schizophrenic subjects were all previously untreated, first admissions to the Zagreb Medical School hospital. In each case a diagnosis of acute paranoid schizophrenia was unanimously agreed upon by three psychiatrists and possible organic complications ruled out. After the experimental subjects had been selected, a search was instituted for the 50 "normal" controls. Each pair of subjects was matched on the basis of age, sex, education, socio-economic background, and occupation. All control subjects also were examined prior to their selection to rule out overt psychiatric illness.

The first problem toward which Sartorius addressed himself was a determination of whether schizophrenics in his sample, in fact, did differ from the control group in terms of their ability to produce abstract concepts. One

of the "multi-dimensional" tests developed by Bujas for his intelligence or creativity test battery was employed. Here, the subjects were evaluated both on the number and quality of abstract concepts formed from a group of verbal stimulus materials. On this test the mean score of the schizophrenic group was a full two standard deviations lower than the mean of the controls, the difference being significant at the 0.001 l.o.c.

Next, a semantic differential scale was administered to determine if the groups differed in the meaning which they attached to the stimulus words used in the "multi-dimensional" test. Again, clear-cut differences were found. The controls produced normal curves, as predicted, in their evaluation of the emotional connotation of the stimulus words. However, the schizophrenic subjects tended to attribute emotional meaning to even "neutral" words and failed to show the same normal distribution of response. Finally, a free association test was administered. Here there were qualitative differences in response between the two groups although total production of words did not differ significantly. The schizophrenic group was less productive in terms of the number of different associations produced. Further analysis of the responses on the three tests disclosed essentially two distinct sub-groups among the schizophrenic sample. One, which Sartorius describes as "rigid," usually was able to provide meaningful answers, but was not sufficiently flexible in thinking to verify the correctness of the answers. The second sub-group clearly was best described as over-inclusive. Thus, while Sartorius' sample of schizophrenics as a group showed a gross limitation of their ability to shift abstract concept, and they clearly differed from the controls in terms of the meaning which words conveyed; they were not uniform in their pattern of thinking. Both concreteness and over-inclusiveness were elicited as characteristic patterns of schizophrenic thought, and one was no more prevalent than the other.

Sartorius' interest in psychopharmacology is primarily directed toward biometric problems in meaningfully classifying patients in drug studies and in evaluating changes in psychiatric status over time. While he has developed a rating scale where curves describing changes in overt psychiatric behavior are plotted on a time scale (with inter-rater reliabilities above 0.85), Sartorius does not consider the rating scale approach to be particularly fruitful. He has now turned to studies in clinical judgment where the psychiatrist or psychologist becomes an

instrument responding to an input of diverse variables. For Sartorius, the problem becomes one of isolating and identifying the variables which are both meaningful and stable indicators of diagnosis and/or change. The information utilized in his studies ranges from biochemical through psychometric. He has been heavily influenced by W.A. Hunt's work in clinical judgment, and has a strong and rather rigid experimental bias. This, combined with his drive, obviously superior ability, training in experimental psychology, and experience in clinical psychiatry, should mark Sartorius as a future leader. At present he is working on a major research problem aimed at identifying meaningful variables in psychiatric diagnosis through cross-cultural studies.

THE INSTITUTE FOR MEDICAL RESEARCH AND INDUSTRIAL HYGIENE, ZAGREB

The psychology laboratory of this Institute, which has a primary mission of research in industrial medicine, was established about 15 years ago. Bujas directs the laboratory, which is staffed primarily by graduate students working on their PhD's. Because of the extensive research investment required for the dissertation, and the sophistication of the students, the work of the laboratory tends to be of high quality. However, this approach to staffing means the average investigator does not remain more than three to five years. At present there are three staff investigators (in addition to Bujas) and one assistant. The senior worker in the group is Dr. Branko Sremac, who recently finished his doctoral research in the area of fatigue. The equipment at this laboratory is quite sophisticated and certainly comparable to that found in the average US psychophysiology laboratory. One of the most intriguing aspects of this group is the amount of complex apparatus which they have constructed themselves.

The program of the laboratory does not appear to be systematically related to that of the Institute as a whole. In fact, one suspects there may be more than a little friction between the psychology laboratory and the rest of the Institute. Some feeling for the work of the laboratory may be obtained from the following summaries.

At present Bujas appears to be most interested in extending his studies of the psychophysics of sensation at the laboratory. He has been working with gustatory, visual, and auditory sensation, and now is focused on an apparent difference he has found in adaptation of the

gustatory mechanism. Briefly, Bujas finds that the rise in slope of the subjective response intensity curve is related to changes in both the absolute and the differential threshold in the case of gustation; but with visual and auditory stimuli only the differential threshold is affected. In the future it is hoped to shed light on the mechanism of this adaptation.

Fatigue studies have occupied the attention of this laboratory over many years and have formed the basis for many doctoral studies. There has been a spurt of studies in recent years on the relationship of work output, psychopharmacology, motivation, and fatigue. Generally speaking, motivation consistently has been found more effective than drugs in offsetting the effects of fatigue. Bujas is somewhat pessimistic about future pay-off in the area of drug studies. However, it is possible that his studies might be more rewarding if a stronger group of pharmacologists were associated with the laboratory.

An extensive series of studies have been carried out by Bujas and his colleagues on the relationship of rest to effective work. Under laboratory as well as field conditions, both the duration and intensity of work - rest periods have been systematically varied. A static work situation has been the major focus of the laboratory studies, while athletes have been used for the field investigations. The research to date rather clearly indicates that either a slowing down or changing of pace is more effective than stopping work. This finding holds good for both laboratory and field studies. Further, where the work load varies, such as in the weight of a series of shot thrown by an athlete in the shot-put, greater efficiency is obtained when the weight of the shot processes from heavy to light with each succeeding throw. Current work in this area is being concentrated on explaining why change of pace leads to a higher sustained level of work efficiency.

A study recently has been completed on the relationship of visual fatigue and flickering of light. This work was motivated by a concern with possible adverse effects of fluorescent lighting in industry. Fifteen subjects were required to read mathematical tables for two-hour periods under a control condition of constant stimulus and three experimental conditions involving flicker fusion -- below-, at-, and above-fusion threshold. Using a counterbalanced design, fatigue was found to be greatest under the above-threshold condition. The study now is being expanded to

include EEG recordings.

B. Sremec's doctoral research is concerned with investigating differences between control and peripheral processes in muscle fatigue. Using alternating current in the peripheral condition to stimulate arm muscles in human subjects, Sremec has obtained fatigue curves which clearly differ from those obtained under normal work conditions. In addition, he has been able to demonstrate the differential influence of several pharmacologic agents and a series of varying work — rest cycles on the fatigue curves.

SUMMARY

From the two institutions in Zagreb it is impossible to generalize on Yugoslavian psychology as a whole. However, the sample seen in Zagreb on the whole was quite impressive. One might have some second thoughts about the degree to which Bujas' influence seemingly permeates all research activity and the consequent implications this holds for the development of healthy controversy and differences of opinion among investigators. Moreover, it is unfortunate that more of the work is not published in foreign journals -- a move which surely would lead to a scientifically healthy professional interaction and stimulation.

Social psychology is grossly under-represented at Zagreb. Reportedly the leading Yugoslav social psychologist is Dr. N. Rot at Belgrade University. An interest in experimental social psychology and cross-cultural research appears to be developing in Ljubljana University Sociology Institute. Dr. Misha Jezernik, a Bujas-trained psychologist with a postdoctoral year in the US, appears to be leading this effort. Jezernik has worked primarily in industrial psychology, and his reasons for entering the area of cross-cultural research are not entirely clear. One suspects, however, that the primary motivation here is in the availability of research funds rather than scientific dedication. After a brief visit to Ljubljana, one also suspects that Jezernik does not enjoy the same status in social psychology as does Rot. In any event, Jezernik certainly has a fertile field for cross-cultural research if he is up to the task facing him. There are few countries with such an elegant natural laboratory within its own boundaries as Yugoslavia.

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*
Office of Naval Research, Branch Office
London, England

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b GROUP

3. REPORT TITLE
NOTES ON PSYCHOLOGICAL TRAINING AND RESEARCH IN YUGOSLAVIA; Psychological Institute, University of Zagreb, and The Institute for Medical Research and Industrial Hygiene, Zagreb

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
N.A.

5. AUTHOR(S) *(Last name, first name, initial)*
RASMUSSEN, John E.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
8 August 1966	16	-

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
N.A.	ONRL-35-66
b. PROJECT NO. N.A.	
c.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*
d.	N.A.

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
N.A.	N.A.

13. ABSTRACT

Brief history and summary of current psychological training and research at Zagreb University and Institute for Medical Research and Industrial Hygiene, Zagreb.

DD FORM 1 JAN 64 1473

Unclassified

UNCLASSIFIED
Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Psychological Training, Yugoslavia Psychological Research, Yugoslavia Zagreb University						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

AD NUMBER: AD0801403

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 25 Aug 1966. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

No. 20-8
25 August 1966

Distributed by the
Office of Naval Research Branch Office,
London

BLANK PAGE

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES Vol. 20 No. 8

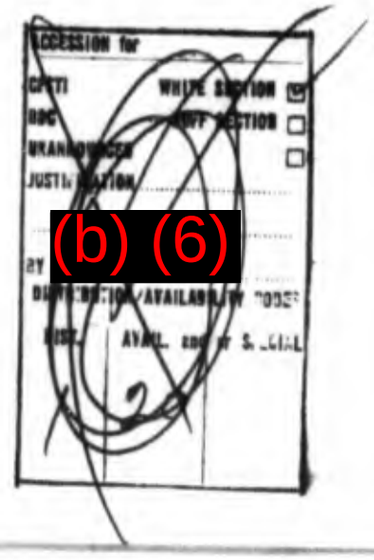
Edited by J.E. Rasmussen and Victoria S. Hewitson

26 August 1966

European Scientific Notes is Group II Newsletter type Class B periodical prepared and distributed by the Office of Naval Research London in accordance with NAVEXOS P-35.

(b) (6)

C.F. Froscher
Captain, U.S. Navy
Commanding Officer



ONR LONDON PERSONNEL CHANGES

Because of the nature of the personnel assignments in ONR London there always are a number of changes during the summer months. This summer is no exception although the changes are probably more extensive than usual. The last month has seen the arrival of both the new Commanding Officer and the new Chief Scientist, as well as many replacements on the scientific staff. This summary has been prepared to introduce the new Commanding Officer and Chief Scientist and to acquaint the readers of ESN with the present Naval Sciences Division staff, who will be responsible for much of the material which appears in this publication during the coming year.

- - - - - - - - - - - - - - -

Captain Clarence T. Froscher USN relieved Captain William W. Schaefer USN as Commanding Officer of the London Branch Office of ONR and as the Assistant U.S. Naval Attache for Research on August 4, 1966.

Captain Clarence T. Froscher USN

Captain William W. Schaefer USN

Captain Froscher, a native of Dade County, Florida, graduated with distinction from the U.S. Naval Academy in June 1942. After serving two years in destroyers in the Pacific Theater, he was assigned to Flight Training and received his Wings on 30 July 1945. Following several tours of duty in Antisubmarine Warfare Patrol Squadrons, Captain Froscher earned a BS in Aeronautical Engineering at the US Naval Postgraduate School and MS in Fluid Mechanics at Stevens Institute of Technology. His subsequent duty assignments have been in the field of aviation research and development, aircraft logistics, and aircraft maintenance. He graduated from the Industrial War College in 1964, and served as Director of the Airframe Division in the Naval Air Systems Command prior to reporting in London.

Captain Schaefer, who served as Commanding Officer of ONRL since August 1964, has been assigned to the Naval Air Systems Command in Washington, D.C. as Executive Director for Field Support.

Mr. Aubrey W. Pryce replaced Dr. Peter King as Chief Scientist and Scientific Director on

Mr. Aubrey W. Pryce

Dr. Peter King

18 August. Mr. Pryce is a native of England and received his BSc from Imperial College of Science and Technology, University of London in 1939. During the war years he served as an Experimental Officer with the Engineering Laboratory of the British Admiralty. From 1947 to 1949 he was a Senior Scientific Officer in the Royal Naval Scientific Service. In 1949 he went to Washington, D.C. as a Navy staff member of what is now the British Defence Staff. In 1951 Mr. Pryce emigrated to the US and joined the staff of ONR Washington as a physicist in the Acoustics Branch. He has been head of that Branch since 1956 and is now on temporary leave of absence to serve in London.

Dr. Peter King, who served as Chief Scientist for the past two years, has assumed his new appointment as Deputy Chief of Naval Research and Chief Scientist of the Office of Naval Research. Washington, D.C.

The present staff of the Naval Sciences Division of ONR London, and their permanent affiliations, are as follows:

Dr. James A. Pierlein: Director, Chemistry Research Laboratory, Aerospace Research Laboratories, Wright-Patterson AFB, Ohio (Rocket research, propulsion).

Dr. Jerome B. Cohen: Professor of Materials Science, Northwestern University (Metallurgy: diffraction, electron microscopy, plastic deformation, thermodynamics).

Dr. John D. Costlow: Assoc. Professor, Duke University at the Duke Marine Laboratory, Beaufort, N.C. (Marine biology, biological oceanography, larval development and distribution, endocrinology of crustaceans).

Mr. Douglas C. Hornig: Chief, Chemical Engineering Division, Naval Ordnance Laboratory, White Oak, Md. has relieved Mr. Malcolm Coate as the NOL representative. (R and D on explosives, propellants and pyrotechnics).

Dr. Maurice W. Long: Chief, Electronics Division, Engineering Experiment Station, Georgia Institute of Technology, Atlanta, Ga. (Physicist (Electronics): Radar detection techniques; electromagnetic scattering from rough surfaces; millimeter and submillimeter waves).

Mr. Paul D. Maycock: Long Range Planning, Corporate Research and Engineering, Texas Instruments, Inc., Dallas, Texas (Solid state physics, advanced semiconductor devices, infrared systems, energy conversion, and thermal analysis).

Captain J.E. Rasmussen MSC USN: Formerly Director, Behavioral Sciences Department, Naval Medical Research Institute (Psychology, psychiatric assessment, human performance under stress).

Dr. Bernard O. Seraphin: Supervisory Research Physicist, NOTS, China Lake, Calif. (Solid state physics: semiconductor surface effects, band structure analysis, semiconductor optics).

Mr. Winfield G. Trott: Head, R and D Dept., U.S. Navy Underwater Sound Reference Laboratory, Orlando, Fla. (Physicist - acoustics (Underwater sound measurement, sonar test and evaluation)).

Dr. Harry E. Williams Assoc. Professor of Engineering, Harvey Mudd College, Claremont, Calif. Formerly with the Cal Tech Jet Propulsion Laboratory (Engineering mechanics - stress analysis, thin shell structures, hydrodynamics).

The following members of the scientific staff recently have departed from London:

Dr. Bodo Bartocha, who was Deputy Director for Naval Sciences, has returned to the Naval Propellant Plant, Indian Head, Md.

Dr. James G. Brennan has resumed his duties as Professor and Chairman, Department of Physics, The Catholic University of America, Washington, D.C.

Dr. Bernard Epstein has returned to the University of New Mexico as Professor of Mathematics.

Dr. John A. Nagay has resumed his duties as Assistant Head, Personnel and Training Branch, Psychological Sciences Division, ONR, Washington, D.C.

Dr. Clarence N. Peiss has returned to the University of Chicago as Professor of Physiology at the Medical School.

Mr. William S. Pellini has resumed his position at the Naval Research Laboratory, Washington, D.C. as Superintendent, Metallurgy Division.

Dr. S.Y. Tyree has joined the faculty of the College of William and Mary, Williamsburg, Va. as Professor of Chemistry.

Dr. Elliot Weinberg has resumed his duties as Chief Scientist at the ONR Branch Office, Pasadena (San Francisco Division).

BIOLOGICAL SCIENCES

Dental Training Conference, Garmisch

The Annual Dental Training Conference of the US Army, Europe, was held 26-28 May in Garmisch, Germany. Present were the Assistant Secretary of the Army for Research and Development, the Hon. Willis M. Hawkins, dental officers from the US Navy and Air Force, and senior dental officers from several foreign countries. Among them were: Lt. Col. Sven Walden (Netherlands), Lt. Col. Leon Richardson (Canada), Group Capt. W. Smith (UK), Lt. Col. Dr. Gerd Schwarz (Germany), Lt. Col. Halldor Trygge Gimmes (Norway), Col. Enver Plumer (Turkey), and the President of the German Dental Association, Dr. Walter Knott.

The meeting was well organized; a morning was given to formal presentations before the entire assembly, and the afternoons were divided into four specialty sessions: Oral Surgery, Periodontics, Prosthodontics, and Restorative Dentistry. At the time of registration, each attendee designated which of the sessions he wished to attend. It was explained that attendance at sessions other than the chosen one could not be encouraged because of space limitations. Since over 400 attended, the restriction was understandable.

Col. Robert Shira (Chief Dental Surgeon, USAREUR) is a distinguished oral surgeon, a fluent, entertaining speaker, and a charming man. No problem was too small -- ranging from accommodation to transportation -- for this busy man to solve.

Principal essayist was Prof. B. Cohen (Royal Coll. of Surgeons of England). His work has been reported by this writer, and much has appeared in the literature. However, since Cohen's work is of such importance, a brief summary of his paper follows: Cohen mentioned the changes taking place in modern research and the impact of technological developments on biological research. He felt that there was some risk of research workers becoming obsessed with the importance of apparatus and succumbing to the fascination of practicing techniques for their own sake.

One of the most important tools in biological research is the experimental animal. For dental investigations the small macaque monkey offers excellent possibilities. The dentition is similar to human, all parts of the mouth are accessible, they thrive and breed on diets identical with human diets, and they develop dental caries, as humans do, when maintained on a highly-refined carbohydrate diet.

The carious lesion in the monkey is similar to those of humans at the morphological, radiological, microscopic, and bacteriological levels. Cohen uses this animal in his research in periodontal dis-

ease. He outlined his published theories on the vulnerability of the interdental area in adolescence. Cohen feels that the initial lesion in periodontal disease often can be traced to events at the time of tooth eruption. He demonstrated a series of experiments on monkeys which were designed to test the hypothesis which arose from his earlier studies.

Cohen described briefly the new dental research unit established at Down, Kent, by the Royal College of Surgeons. Facilities are available for 200-300 monkeys. The research program is planned to encompass caries and periodontal disease as well as other fields -- cleft palate, salivary functions, tumors of the joints, and the testing of filling materials and other therapeutic substances. (C.E. Meyers)

The 7th International Congress of Gerontology

The 7th International Congress of Gerontology was held 26 June - 2 July at the Hofbung-Kongresszentrum in Vienna, Austria. As did the other six Congresses, it applied a wide variety of viewpoints to the problems associated with physiological aging.

There were 101 sessions in all, covering the areas of Biology (including biochemistry and biophysics), Clinical Medicine, Economics, Education, Psychology, and Sociology. Clinical Medicine received the greatest emphasis with 51 sessions devoted to such topics as senile dementia, cardiovascular disease, surgery, and diseases of bones and joints. The general opinion among attendees was that noticeable advances had been made in almost every area since the last Congress (Copenhagen, Denmark; 1963).

The attendees numbered over 3,000 professional people representing forty-four countries. Such leading scientists as F. Verzar (Switzerland) and N.W. Shock (USA) were among those present. The country most heavily represented was the US, accounting for about 10% of the total participants. Germany, Austria, and Great Britain were also well represented. This was a large increase in attendance over that of the preceding Congress. The large increase is of some interest because it roughly indicates the growing world concern with gerontological problems. The Austrian Government is very much aware of the world's growing interest, and its representatives were quite emphatic (in opening session addresses to the entire Congress) in pointing out that Vienna is an excellent, "centrally-located" meeting place where "diverse cultures"might work in harmony. They also commented on the historical fame of the Vienna School of Medicine, and on the fact that the President of the International Gerontological Society is an Austrian, Prim. Doz. Dr. W. Doberauer. They invited permanent use of Vienna as a scientific headquarters and meeting place.

Scientifically, there is a growing interest in J. Bjorksten's theory that aging is basically due to the cross-linkage of protein molecules. In investigation along these lines, a large amount of research has gone into the biochemistry of aged tissue, with special emphasis on cross-linkage processes in collagen. The evidence accumulated so far suggests that J. Bjorksten could well be correct.

A disappointing feature of the Congress was that only three papers were presented on gerontological biophysics, and two of these were essentially strength of materials studies.

Overall, the major effort in gerontology is presently directed toward treatment of the symptoms of physiological aging, with a small but growing effort aimed at understanding the biochemistry of aging, and an almost nonexistent effort directed at the biophysics of aging. However, despite the small numerical size of the effort, the rate of progress of research into the basic cause (or causes) of aging indicates that a major increase in "useful" lifespan could well result within the next ten years. (D.G. Carpenter, Major, USAF, Physics Department, USAF Academy, Colorado 80840)

MATERIALS SCIENCES

Materials Science Club

About 200 scientists and engineers interested in all aspects of materials have formed a club in the UK. They meet about three times a year to present papers, and more important, for discussions. (This fall, for example, there will be a meeting on compatibility of composites involving metals, ceramics, plastics, cements, etc.) Some of the activities of the members will illustrate the scope of this informal group.

Prof. R.W. Cahn (Sussex Univ.), club chairman, has started an interesting new periodical, Journal of Materials Science. It brings together science and technology in a very well-done format. For example, papers on "The Measurement of Ionic Diffusion in LiF by NMR Techniques" and "A Review of the Use of Electron Beam Machines for Thermal Milling" appear in the first two issues.

Mr. L. Holiday (The Shell Chemical Co., Ltd., Manchester) edited the book, Composite Materials, recently published by Elsevier. Prof. W.A. Holmes-Walker, secretary, has initiated a program on materials at Brunel College, Acton, London.

While the plans for this College are not immediately connected to the activities of the club, an explanatory bit may not be out of order here. The College has received its charter as a University, and will move to its new campus in Uxbridge next year. A school of materials science is planned. After the first common year, students will be able to specialize in polymer science, metallurgy or ceramics. (Their entire program covers four years, involving periods in industry from April to October of each year.) (J.B. Cohen)

The Crystallographic Group at Battersea

The Crystallographic Group at Battersea College of Technology, a part of the Chemical Physics Department, is housed in the old St. John's School. This is one of many small, scattered buildings in Battersea serving as temporary sites for this College as it awaits its new campus in 1968, when it will become the new University of Surrey. A detailed report on the organization of science in the school and its educational program appeared in ONRL Tech. Report 21-66. Suffice it to say that this school has already embarked on a program which gives new students considerable exposure to all of the various fields of engineering and science and time to

"choose" among these at the beginning of their studies.

The Crystallographic Group is well equipped. There are about 14 units, including five diffractometers. About 50 undergraduate and 40 MSc students are trained annually in formal course work in this laboratory. (The MSc consists mainly of course work with a small project; in a break from tradition which seems to be a trend in the UK, the PhD candidates are urged to take course work for this degree.)

Dr. D. Lewis, a Reader in the Department, leads the group. Having been trained by Prof. Bernal, his research interests are far-ranging and interesting. The laboratory also serves informally as a service facility for other departments at the school, and I felt that I was back at my own lab when Dr. A. Crocker arrived with some of his students to discuss some unusual effects they had observed in Laue patterns from Mg.

Research is in three main areas:

(1) By use of Berg-Barrett photography, a study is being made of the primary and secondary deformation bands in single crystals of Al. Surprisingly, they form quite early in the deformation, in Stage I of the stress-strain curve. They start as short segments from the edge of the crystal and then spread across the width of the specimen. (This work is a continuation of Lewis' PhD research.)

(2) The habit of calcium carbonate scale is being examined. It has been found that this scale starts on the rough iron oxide inside a boiler or in water desalinization equipment, but does not grow epitaxially. Rather, it is mechanically occluded at ledges and holes. The group hopes to alter the subsequent build-up of the scale by altering the morphology in order to produce a fine powder that will flake and fall off. Attempts at causing these changes are being made with electrical fields.

(3) A very large effort is being put into the study of grinding halides, oxides and carbides (such as WC). Line broadening is the tool employed; in particular, integral line breadths of many peaks are examined to obtain particle size and microstrain. Measurements of the particle size in fine commercial powders with this method were found to be in excellent agreement with those obtained using electron microscopy and gas absorption. They discovered that with some of these powders, there was considerable broadening due to strain. On pulverizing bulk specimens of these materials, they found that for the first few minutes of grinding, the particle size was reduced to about 1000 Å. This was the true fragmentation size, as the same sizes were found on examining the powder in the electron microscope. Additional grinding caused no further reduction of the particle size, but quite surprisingly the mean micro-strain increased, reaching levels ten times those found in metals. These strains tend to vary as do the elastic constants, so that the materials appear to be under a residual stress independent of crystallographic direction. (This is similar to the micro-strain distribution in bcc metals, but in fcc metals, the microstrains do not vary as much with direction as do the elastic constants. Many of the oxides and halides examined by Lewis had fcc lattices.) As a result of this finding, the measurements can be used to obtain information on the ratios of elastic constants in different crystallographic directions. More important, the stored energy in these materials is quite large, well in excess of the surface energy associated with each particle. The sintering kinetics of milled substances should then be strongly affected by stress-induced diffusion; indeed, they find that sintering of Al_2O_3 will occur in a well-milled powder some 200° C lower than with the same powder in the annealed form.

With calcite, they hope to measure the energy of transformation to aragonite; the strain broadening of calcite levels-off with increasing grinding, and then aragonite lines appear in the pattern and grow in intensity, while those from the remaining calcite stay broad and decrease in intensity. Thus, the stored strain energy should be a measure of the transformation enthalpy.

This work clearly shows the ductility of many of the so-called brittle materials when the particle size is small. It is, in fact, well-known that many brittle compounds will deform considerably when their particle size is small and the particles are surrounded by a ductile matrix. Line broadening could prove to be a valuable method for studying the deformation of such materials.
(J.B. Cohen)

Chemical Education in Scotland

One is constantly exposed to the comment in the British Isles that Scottish universities are much more like American universities than are their English counterparts. In naive acceptance of this point of view, I had presumed that this meant that a student, during the course of his university education in Scotland, would indeed be exposed to a fair variety of disciplines. Such is not at all the case, and, should there be others who may be under the same illusion that I was, I would like to set the matter straight by giving a reasonable description of what education in chemistry is really like in Scottish universities.

The principal difference between the Scottish university educational system and the English is in the number of years each requires. To obtain an honors degree in chemistry at a Scottish university, the normal curriculum requires four years. Some very few students are admitted to "advanced standing," whereby they start in the second year and complete the honors degree in three years' time, exactly the equivalent of the English honors degree. The difference then is that students from the secondary school systems in Scotland come to university far less well-prepared in chemistry, mathematics and physics, than do their English counterparts. This is due to the fact that quite distinct sets of university-qualifying examinations are administered in the two geographical areas. The student in England, preparing for the university, is expected to specialize during his last two years, reading intensively in those subjects in which he expects to major at the college level. On the contrary, in Scotland the emphasis, in the secondary system, is on breadth of education. Thus, the first year a student matriculates in a Scottish university is devoted to what we would call general chemistry, general physics, and introductory mathematics. It is noteworthy to

stipulate that these are the only subjects studied by a chemistry major. The second through the fourth years of study in a Scottish university is very similar to the three years required for an honors degree in chemistry in an English university. Just for the record, let it be stated explicitly that a chemistry major will take no courses in English, history, art, political science, etc. He will study chemistry each of his four years with a bit of physics and math sprinkled in fairly liberally during the first year, in very small doses during the second and none at all in the last two.

In substance I would like to reiterate that the Scottish universities and American universities are alike in one, and only one, respect as I see it; to wit, the number of years required for the BS degree in chemistry, or whatever subject-matter discipline the student wishes to major in. In all other respects, it is my opinion that the Scottish universities are much more nearly akin to the English universities. (S.Y. Tyree)

Inorganic Chemistry at Aberdeen

H.F.W. Taylor was appointed Professor of Inorganic Chemistry at the University of Aberdeen one and a half years ago. His staff is composed of W. Moser, Reader; and the following inorganic lecturers: F.P. and L.S.D. Glasser (husband and wife), J.A. Gard, J.A. Duffy, G.P. McQuillan, J.H. Binks, and J.H. Holloway.

Taylor and the Glassers are crystallographers applying their methodology to the study of reactions among solid silicate phases. W. Moser is an expert in Sn(II) chemistry. Gard's specialty is electron microscopy. Binks is interested in theoretical inorganic chemistry. Holloway, a fluorine-chemist, is on leave at the Argonne National Laboratory for six months. McQuillan is a coordination compound chemist studying the new ligands $(C_6H_5)_3PS$, $(C_6H_5)_3PSe$, $(C_6H_5)_3AsS$, $(C_6H_5)_3SbS$, $(H_2N)_2CSe$ as donors toward $PdCl_2$, $HgCl_2$, $AuCl_3$, $TlCl$. Duffy does visible and infrared spectroscopy of transition metal solute species in aqueous media and in H_2SO_4.

Approximately 20 graduate students are working towards advanced degrees in inorganic chemistry. This represents about one-third of the total interest in chemistry at Aberdeen (the other two groups are physical and organic chemistry). An addition to the chemistry building, now under construction, will approximately double the present, modern facility. (S.Y. Tyree)

Inorganic Chemistry at Edinburgh

The comparison between inorganic chemistry at Edinburgh with that at Aberdeen is like unto the same comparison between Strathclyde and the University of Glasgow, both in Glasgow. In both Strathclyde and Aberdeen very strong, large groups, each headed by a Professor, maintain extensive research programs in inorganic chemistry. At the Universities of Glasgow and Edinburgh the situation is strikingly different, for in each of the schools of chemistry, the inorganic staff numbers three. In Glasgow the senior man, D.S. Payne, is a reader. In Edinburgh the senior man is only a lecturer. As might be expected, only a handful of graduate students major in inorganic chemistry.

The three senior staff in inorganic chemistry at the University of Edinburgh are: W.P. Doyle, R.O. Gould, and M.M. Harding (Mrs.). The latter is a crystallographer with interests in metal complexes. Gould is a young man who is a student of complex ion chemistry, but at the moment, learning x-ray crystallography by doing a structure. Doyle, the senior man, has developed an excellent technique for the measurement of diffuse reflectance spectra of inorganic materials. Some idea of his progress in this field can be obtained by reading one of his recent papers (J. Inorg. Nucl. Chem. 27, 1271-80 (1965)) in which Job's method of continuous variations has been applied to reactions between solids. The reflectance spectra obtained by Doyle and his students are better than any other reflectance spectra I have seen. (S.Y. Tyree)

Inorganic Chemistry in Vienna

There are two universities in Vienna, and thus two chemistry departments. At the University of Vienna, the chair in Inorganic Chemistry is to be filled shortly. Meanwhile, some inorganic chemistry is done in the Institute of Physical Chemistry under Prof. H. Nowotny. Nowotny's own interests are in the "refractory-hard"metal field; synthesis and characterization of metal carbides, nitrides, etc., i.e., highly refractory materials. However, one of his associates, N. Konopik, is interested in the hydrolytic behavior of germanic acid. In the pH range of 6→11 and from 10^{-3} M to 0.024 M total Ge, very careful pH titrations were performed. The species postulated in the solution are a function of the way she chooses to treat her data. Isopolyions are present, and her most recent preference is for an octamer. It is questionable whether or not the solutions represent the true equilibrium state.

At the Technical University of Vienna, Dr. V. Gutmann is the Professor of Inorganic Chemistry and Director of the Institute of Inorganic Chemistry. Gutmann has initiated a most ambitious and long-range program of non-aqueous chemistry. For a given solvent and a large number of metal ions, he is comparing the strength of a series of donor ligands by measuring formation constants. For the same metal ions the same series of donor ligands are to be compared in several non-aqueous solvents. This is to be a serious attempt to get at solvent effects; but it is apt to take a long time. Since all of the work is in non-aqueous solvents, it is most time-consuming since anhydrous conditions must be maintained.

The senior dozent under Gutmann is Dr. Meller, a jovial Viennese interested in B-N compounds. He has a small group of graduate students developing new methods of synthesis of B-N compounds and attempting the preparation of new compounds. Also he is completing a review paper on the subject.

The situation for young scientists in Austria is deplorable. The young PhD has three choices: (1) instructor in an Austrian Chemistry Department at ca. $125 a month. (2) industrial chemistry at ca. $250, or (3) emigrate. In questioning several young instructors in chemistry departments in Austria about the source of their automobile on the $125 a month salary,

two answers only were obtained. They either got the car while working as a post doctoral in the USA, or it was given to them by a relative .... Even in the matter of instrumentation it is apparent that Austrian chemists do not enjoy the affluence of the chemists in France, Germany, Italy, England and Scandinavia. Most certainly all of the laboratory buildings are pre-WW II, if not pre-WW I. It is a bit surprising to the writer that Austria is able to hold any of its really able scientists. (S.Y. Tyree)

Inorganic Chemistry at Innsbruck

E. Hayek is the Professor of Inorganic Chemistry and Director of the Institute of Inorganic and Analytical Chemistry at the University of Innsbruck. Chemistry is presently located in a very old building at Innsbruck, but it will soon be transferred to a building which was originally built for them at the University, but was converted for use as a press building during the 1964 winter Olympics. As yet, the equipping for use as a chemistry building seems to be a matter of less urgency than was its equipping for use by the press prior to the Olympics.

Hayek's interests have been for many years centered around basic salts, hydroxides, and their preparation from and relation to dissolved metal salts. His well-known older work on the solubilities of certain metal oxides and hydroxides in aqueous solutions of salts of the same metals anticipated the identification of many of the isopolycations "identified" recently by more modern techniques. His interests continue in the same area.

Dr. A. Engelbrecht has been made a professor in inorganic chemistry (without chair). He is a fluorine chemist, well known some 10 years ago for his preparation of perchloryl fluoride. Continuing his interests in fluorine chemistry, Engelbrecht and his students have most recently prepared a variety of derivatives of the -TeF_5 group. (S.Y. Tyree)

Inorganic Chemistry at the Technische Hochschule of Munich

There are three institutes of chemistry in the Technische Hochschule of Munich (THM), one for Physical Chemistry, another for Organic Chemistry, and the other for Inorganic Chemistry. The Professor of Inorganic Chemistry and Director of the Institute of Inorganic Chemistry is Dr. E.O. Fischer. This chair is the same one occupied for many years by Hieber. The latter is retired, but comes into the laboratory nearly every day. H. Lux and J. Jander are also professors without chair in the Institute, and there are three dozents.

At the moment Fischer's Institute is suffering from a problem which appears to be general over all of Germany. While the birthrate in the USA was climbing during the last years of and immediately after WW II, the birthrate in Germany declined sharply during the same period. Now, all students matriculating in chemistry at THM begin their studies in Fischer's institute. His teaching laboratories, designed for an entering class of 80, are now used for a class of 42 students, with some of those being recruited abroad. On the other hand, based on previous experience, Fischer anticipates that somewhat better than one-half of a class of first-year students will usually continue all the way through to the doctor's degree. Thus the drop-off has yet to be felt at the graduate level, but is about at the bottom of the curve for the first-year class.

Fischer himself continues to be what he describes as a "preparative" inorganic chemist. At the moment he is still very excited about "carbene compounds." One of his dozents, Dr. Fritz, is in charge of spectroscopy in the Institute. Fritz's equipment is extensive and excellent since Fischer is convinced of the efficacy of all kinds of spectroscopic tools as aids to chemical synthesis and characterization. Varian machines are used for nmr. German machines are used for esr and mass spectroscopy. A variety of infrared machines from several sources are available. (S.Y. Tyree)

MISCELLANEOUS

Navy European Patents Program

The Navy European Patents Program was established in the Spring of 1960. Prior to the establishment of the Program, certain international patent problems affecting the Navy were from time to time brought to the attention of the Navy Patent Counsel. In recognition that such foreign problems are not readily revealed or primarily solved without on-site Navy Patent representation, NEPP was set up in London. The primary mission of the Office of Patent Counsel, ONR London, is to support the Chief of Naval Research by providing services relating to patents, inventions, trademarks, copyrights, royalty payments, and matters connected therewith. A unique function of this office is to provide information regarding the patent policies of governments whose dealings with the US Government, within the framework of NATO and under certain bilateral agreements, generate international patent problems for the Navy. The Patent Counsel is responsible to the Commanding Officer of ONR London for the organization, the administration and the supervision of the Program and for providing services in accordance with the law and such other directives, orders or instructions as may be issued by proper authority. The Office is under the technical and management direction of the Assistant Chief of Naval Research for Patents.

The purpose of this article is to give a clear understanding of the Navy's interests in inventive ideas, to outline some of the problems encountered in connection with patents, and to clarify the routines to be followed in submitting matters to the Navy Patent Organization's representative for patent matters. It is written not only to describe the functions of NEPP and the services which it performs, but also to draw attention to the responsibility of Government employees and Government contractors in connection with patent matters, and to provide information about the services, advice and assistance which the local Patent Counsel can render in his work.

The most reliable indication of the nature of the position as Director, US Navy European Patents Program, is the manner in which the time of the Director is occupied. Because the position is different from the usual Patent Counsel's billet, a large portion of his time is spent initially in

establishing and maintaining contacts with his European counterparts and acquiring at least the basic knowledge of patent laws of European countries. A substantial part of his time is devoted to merely keeping abreast of patent developments in Europe as well as reviewing the International Industrial Property Laws and Regulations of the European countries and International Agreements affecting the US Government's operations in Europe. In addition, the Director is expected by his foreign associates to be well informed on American patent law and practice and US Government patent policy. Accordingly, he relies on a steady communication from the Washington Office and reviews various patent publications.

In addition to the information-gathering function of this office, a program of patent contract follow-up has been instituted in conjunction with the contracts let by the Navy European Research Contracts Program. This involves eliciting patent disclosures from those contractors who have made inventions during the course of their contract work as required by the usual patent clauses of the contracts and liaison with the officials of the foreign government regarding the security classification of patent applications filed by contractors in the foreign countries. Results to date have proven that a vigorous program of patent follow-up has uncovered inventions which would otherwise remain unreported and unpatented. In many cases the inventor is a university professor who does not have the funds to file a patent application in the United States. In such cases this office may file a US patent application if the Navy has a sufficient interest to justify filing.

In addition to contract follow-up, some time is devoted to what may be called contract patent policy work. This involves drafting, in conjunction with European Counsel for the Army and Air Force, patent provisions for use in European research contracts, coordination with the European governmental organizations concerned with the patent provisions of research contracts in Europe, and the explanation of the clauses and the reason for their use in Europe through the ONR member of ASPR Patent Subcommittee.

The Director attends meetings of the NATO Working Group on Industrial Property at NATO Headquarters, where he assists the US Legal Advisor.

In addition, this office has the responsibility for the transmission of classified patent applications and correspondence relating thereto in those cases in which US private citizens file a patent application in Britain covering classified inventions. By centralizing this function in this office, it has been possible to expedite processing where necessary to preserve the foreign rights of these American applicants, and at the same time to provide assistance to any UK patent agent puzzled by the required methods of handling with regard to these classified applications.

The greatest proportion of the Director's time is spent on what might be called miscellaneous patent, trademark, and copyright matters. Such miscellany covers a broad spectrum, and a selection of representative examples are included to indicate the diversity of the subject matter which may be encountered. For example, he participates in negotiations of bilateral and multilateral agreements involving patent matters, provides on-the-spot assistance and guidance to patent personnel of foreign governments, explains, interprets and aids in carrying out arrangements concerning the international interchange of patent rights and technical information, et al.

Why Does the Government Need Patent Protection? - The Navy's extensive research and development program reaches into virtually every field of science and branch of engineering. Navy laboratories and private industrial plants performing research and development work under Navy contracts are constantly developing new and useful machines, compositions, processes, and items of manufacture. Since these inventions are property of an intangible nature, they must be protected by patents if the Government is to avoid payment of unnecessary royalties. One of the best means of protecting the Government against unnecessary liabilities and expense for patent infringement is a systematic program for the acquisition of patent rights. The Navy Patent Organization, established by ONR, provides the Navy with protection in these and other respects. Specifically, this Organization considers claims of patent infringement; files patent applications on inventions selected after Navy-wide evaluation; determines rights of the Government and the inventors, and secures licenses or assignments on appropriate inventions; and evaluates inventions and suggestions about them submitted by persons outside of the Navy to determine the extent of Navy interest. Each year the Patent Organization processes more than 2,000 invention disclosures, prepares an average of 700 patent applications, secures the grant of more than 600 patents, investigates approximately 35 patent infringement claims, and assists in defending the Government in about 40 suits in the Court of Claims.

There has been found to be considerable misapprehension as to the nature of a patent and the rights granted by the patent. Many people who are benefited most by the patent system are unaware of its real meaning and its immense value. It is therefore considered helpful at the outset to make clear what a patent is and to outline steps that must be taken to obtain a patent. By documenting his invention by means of a patent, an inventor may feel certain that his research efforts will not be lost, that other individuals or groups can profit from his experience, and that, perhaps most gratifying of all, his contribution may represent an advance in the defense pursuit of the United States and the free world. The issuance of a patent increases the stature of the inventor, both as an individual and as a Navy employee, because it gives tangible evidence of his professional ability. Moreover, patents are given wide publicity in patent journals and technical literature, and those concepts which are of particular public interest are often noted in trade journals and in the local national press. Other benefits also accrue to Navy inventors. When an invention disclosure has been authorized for preparation into a patent application, the Navy employee inventor is considered for a monetary award. Under the Navy incentive awards program, he is granted a minimum of $50 when his patent application is filed, and

he may be given additional monetary awards, depending on the merits of the invention and its use.

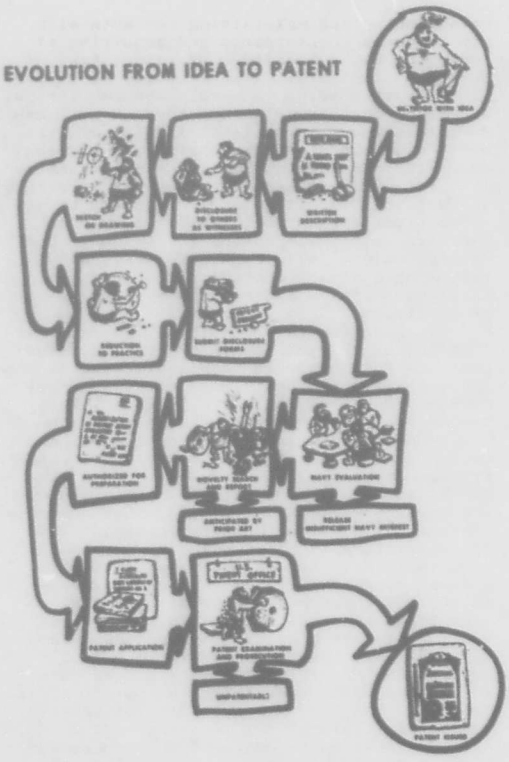
What can be patented? - Most patentable material falls into the following categories:

1. A process, art, or method of achieving a physical or chemical change in character or condition of an object or a material.
2. An apparatus or mechanical device, the interrelated parts of which function in conjunction with one another.
3. An article which is manufactured or made.
4. A composition of matter, such as a chemical compound or mixture of substances.

Recording the Concept - It is of utmost importance to an inventor to be able to provide the evidence needed to show the history of his invention. A chronological record of each step should be made in a bound notebook that is signed, dated, and witnessed. The inventor should then obtain a witness' dated signature and statement that the invention was disclosed to and understood by him. When possible, a drawing - signed, dated, and witnessed - should be made part of the record.

Step by Step to a Patent - When an invention is made, the Patent Counsel usually doesn't know about it until he is told. There are probably many ways that one can bring his invention to the attention of the Patent Counsel; and if one has any questions he should either call or drop into the Counsel's office for a discussion of the problem. Like most things, there is a preferred way to submit an invention. This is done by completing an original and two copies of Standard Form, NAVEXOS 2374, entitled "Record and Disclosure of Invention." This form has been designed to provide a convenient method for submitting the necessary information which will enable the Patent Counsel to begin to protect the idea. Copies of this form may be secured from a Navy supply office, or from the Patent Counsel's Office.

Evolution from Idea to Patent -



Conclusion - Summarizing, some of the most important thoughts mentioned previously will be repeated.

1. Keep a record of what you invent and have such records witnessed and understood by fellow employees capable of understanding the records.
2. Refer new developments to the Patent Counsel as soon as possible after the developments start.
3. Submit all apparently novel ideas and developments to the Patent Counsel regardless of whether or not it is thought they will be useful to the Navy.
4. Supply the Patent Counsel with as complete information as possible about each development submitted.
5. It should be made clear that the Patent Counsel is available to give service. You should feel free to discuss any patent questions with him, no matter how trivial they may seem.

Typical liaison services provided to date have included a survey of the patent practices of the British Government, and assisting NASA with their foreign patent matters. (F.A. Lukasik)

The Sport of Kings and Computers

The National Association of Bookmakers in England are planning to utilize a computer to calculate true place odds to be paid by bookmakers. These odds are now determined by the amount of money invested on horses to win, with the bookmaker generally paying one-

quarter the win odds for a horse backed to finish in the first three. The new odds will be computed to allow bookmakers a profit not exceeding 12½%.

It appears that they will benefit greater in races with a large number of runners. It is estimated that in the Grand National this year, the computed odds would have reduced slightly the place odds on the first three in the betting market, but would have extended them for practically every other runner, with increases of up to 60%. (R.L. McCracken)

PHYSICAL SCIENCES

British Defence Communications Satellite Work

An officer and twenty-two ratings from the Royal Navy are manning Britain's first military communications satellite ground terminal, located on grounds of the Signals Research and Development Establishment overlooking the glorious bathing beach near Christchurch (Hampshire). This is the first of three installations to be followed by similar military terminals, one in the Middle East to be manned by the RAF, and one in the Far East to be manned by the Army.

The Christchurch terminal has been operating daily in actual communications with a US Army terminal at Fort Dix, New Jersey, and in performing development tests via the IDCSP (Initial Defense Communications Satellite Project) satellites. The first set of seven of these satellites was launched on 16 June 1966 by the US Air Force, all in one launch, using the TITAN III-C launch vehicle.

The three terminals, which were developed and manufactured for the Ministry of Aviation by Marconi Ltd., of Chelmsford (Essex), employ 45-ft Cassegrain-feed parabolic dishes mounted inside 65-ft-high inflated radomes. The terminals are of a unique British design, but several of the critical components, including the Varian klystron and the AIL parametric amplifiers, were subcontracted to US firms.

SRDE employed a Philco satellite simulator (a sort of dummy satellite which performs electronically like a real one) prior to the launch, and mounted it on a high cliff on the Isle of Wight for crew practice and in order to align and test their equipment.

A two-year test period is planned for their terminals. If by the end of that time the results measure up to optimistic forecasts, a large number of military terminals will be fabricated to support the British defense installations on ship and shore throughout the world. The Royal Navy in particular is planning to employ small terminals using 6-8 ft dishes aboard all their combat ships, and the Army is very interested in developing terminals to mount on Land-Rovers.

The British are deadly serious about their communications satellite work, and accordingly, we note with unintended humor a remark in The Times (London) of 4 August 1966: "Indeed, with a central switchboard in Whitehall the first Sea Lord in his London office could speak to the flag officer, Far East, with no more difficulty than an S.T.D. caller has in making a call to any part of Britain." (Presuming of course that he can find a three-penny bit!) (B.I. Edelson)

Stimulated Emission and Molecular Processes

On 31 May, A. Kastler, President, convened the 16th Annual Meeting of the French Society of Chemical Physics. Having chosen the above topic for their four-day meeting, the organization Committee proceeded to invite a number of laser luminaries to report on recent research in this field. Lasers being "in" these days, some 250 individuals managed to get their names on the roster of registrants, and, depending on which paper was being given, some actually appeared at the UNESCO Palace from time to time. Considering the various competitive attractions offered by Paris in the spring, we are happy to note that almost never (while we were present at any rate) did the attendance drop below 30.

Having written in some detail about the UNESCO Palace in a recent issue of this Journal (ESN-20-5, pp. 73) we confine ourselves to a single addendum here. Namely, simultaneous translation facilities were not provided on this occasion; papers were given in either French or in English, with occasional anguished cries of "Slower, please" when individual neuron paths became overloaded.

Activities of the first two days centered around the increasingly popular CO_2 laser, with some attention also given to other molecular gas lasers and to more general research in molecular energy exchange involving CO, N_2O, N_2, O, H_2O, et al.

As an invited paper for the second day C. Patel offered a fine review of molecular lasers, which could produce, initially in 1964, only a few mW but now yield several hundred watts CW and efficiencies over 10% in present systems. Patel's well-attended paper reviewed electron impact excitation in pulsed CO, NH_3, CN, CH_3, H_2O and others; vibrational transfer in N_2-CO_2, N_2-CO, and N_2-N_2O systems; and chemical excitation in pulsed HCl and others.

Unlike previous papers which outlined rather minor but recent research results, Patel's was a carefully selected broad summary, eventually focusing down to a presentation of some details on his own recent research. Here the question of the mechanism by which foreign gases prove effective in laser systems was analyzed. One wants to know whether the process involves speeding up the upper-state excitation reaction or of increasing relaxation from the lower lasing state to the ground state. At Bell Laboratories, Patel's group has developed a nice experiment for adding foreign gas to CO_2-only, or to the CO_2-N_2 mixture at a later stage, thus, hopefully, enabling some sorting out of these two effects. Very recent results indicate that in adding H_2 the effective action is with CO_2, i.e., a lower-state depopulation, while for He the effect is largely on the N_2, which implies a contribution to the excitation of the upper state or a more general modification of the discharge. For O_2 very tentative results appear to show an effect similar to that of He.

On another topic, Patel pointed out that with relatively long lifetime ($t \approx 1$ msec) repetitive Q-switching can easily be accomplished, and at the moment 10 KW, 100 nanosec pulses are available, and some interesting applications other than burning up chunks of wood should be expected. The existence of an atmospheric "window" at the lasing frequency should provide some challenge, and the possibility of further investigation of non-linear effects should also be enhanced.

Summarizing, the speaker listed the following properties of molecular gas lasers as indigenous to the species:

a. Low gain (3 dB/m), high-power transitions

b. High efficiency (10-20%)

c. Power out on a number of closely spaced lines, with competition between various transitions

d. Ability to be Q-switched as noted above.

During some of the later papers, it was amusing to note a discussion on how to terminate such high-power, infrared laser systems. Evidently one cannot keep setting blocks of wood down at the end of the laser runway, with a continuous fire resulting -- nor can one simply dump the beam out the open window with consequent instant cooking of any wandering target. Some kind of absorbing black hole is needed, and one or two rather obvious designs were described.

Essentially, Patel set the tone of the second day's proceedings by posing the questions, and the various contributors provided some of the answers. W.J. Witteman (Eindhoven), for example, showed that the presence of impurities at pressures as low as 10^{-4} torr, appreciably affected his results. Specifically, even well-cooked and outgassed pyrex may provide such a degree of impurity, so that fused quartz is highly recommended. Employing this latter envelop, and hollow cylindrical electrodes which emit only from their inner surfaces, Witteman obtained 100 watts, CW, at 12.5% efficiency in a 2-m-long "atmosphere" laser, as these combinations of CO_2,N_2, H_2O are often called.

During the latter half of the second day and for the entire third day, chemical lasers, as variously interpreted, were given free rein. While little more could be said than was already described in the La Jolla Chemical Laser meeting about two years ago, it, nevertheless, could be said in greater detail -- and it was! Starting with a review of some of his father's work of 25 years ago, J.C. Polanyi of Toronto presented experimental results and a general survey of the entire field. Well-presented, lucid and incisive, this talk served to delineate the various types of reactions which may be expected to produce lasering. While, originally, the term chemical, as applied to lasers, was intended to mean that the original source for the energy in the beam should be found in the chemical reactants themselves, more recent relaxation of this requirement has allowed processes in which photo-dissociation, with resultant excited species and levels, to be counted. Polanyi described his own research in which HI is bombarded with H atoms from a discharge source and emission from atomic iodine is observed. Alternatively by employing 2537 A° light instead of a discharge source to obtain H atoms, he was able to observe similar results. The reaction is simply $H + HI \rightarrow H_2 + I^{(*)}$.

In general, it would appear that speculation on the future of chemical lasers, and their possible importance as compact, efficient sources, continues unabated. Problems are no nearer solution, and to this listener, at least, most of the papers sounded very much the same as they did two years ago.

A paper by G. Oster (Brooklyn Polytechnic) proved provocative in that Oster's data suggested to him that a very long-lived (over 40 msec) fluorescence in a compound of polymerized fluorescein in methyl methacrylate might be evidence of stimulated emission. A threshold was observed, but studies were not as complete as he would have liked -- partly due to the rapid carbonization of the central section after only four above-threshold pump flashes. As Oster noted, this sort of device could become an integral part of the American economy -- as the first of the "throw-away" lasers! In general, it was admitted that no line-narrowing had been observed, and no study had yet been made of the angular distribution of the radiation -- two bits of data which are surely essential before one can substantiate the presence of laser action. The very large gain reported may still prove to be caused by an as yet unidentified geometrical factor -- but the report was certainly an interesting one -- if not yet definitive.

By and large, the third day, in which the above paper was presented, was a day for chemists, with europium in chelates and various rare earths in dye solution serving as principal topics on the agenda, and with attendance relatively low. The final day of the meeting found nearly all attendees physically present, a circumstance, due at least in part, to the promised paper by B.P. Stoicheff of Toronto and to one by G. Mayer of CGTSF, Orsay. Naturally these authors developed their own work in Stimulated Raman Emission (SRE) and absorption -- Stoicheff making his offering in English; Mayer in French. As Stoicheff noted, the topic of SRE has provoked the interest of theorists from a time even before lasers had come into being. However, "Theorists have been interesting -- but not helpful to the experimentalists," Stoicheff reports. He also added that "... no matter what experiment is performed to clarify the situation, one simply gets deeper into the mud."

Pointing out that in such compounds as C_6H_6, and CS_2 extra components are observed, Stoicheff suggests that one is probably seeing cooperative effects between different molecules and that one important application of stimulated Raman emission might be to reveal the degree of molecular coupling in various solutions. In addition, a study of the spectra of short-lived species might also be "in the cards" if pulse times can be improved.

During the second half of his lecture, Stoicheff concentrated on the angular dependence of this stimulated radiation, once more remarking upon the difficulty of reconciling experiments with any reasonable theory. We join him in hoping that the advent of a new generation of very clean, single-mode, lasers will reduce the number of variables presently contributing to the general atmosphere of confusion. Developed with great care, patience and humor, Stoicheff's paper fully warranted the large attendance and warm applause it received.

While the schedule throughout the course of the meeting was the traditional one, allowing for the usual 2½ hour lunch break -- a minimum time, in our opinion, to enjoy a truly French lunch, we must record here, with some sadness, a new policy which may eventually be found in force for future meetings. For while our laser conference carried on, President de Gaulle and his Cabinet announced

a complete reform of the traditional civil service work pattern. Affecting the 60,000 or so civil servants who work in Paris, their new schedule calls for only a half hour lunch break. Henceforth they will have a five-day week, starting at 0845 and ending at 6 pm. Previously they had worked a five and a half-day week, and until 7 pm. To be successful, Prime Minister Pompidou called for a "certain discipline" in working habits. Specifically, he urged his ministerial colleagues not to start handing out new assignments to their employees near 6 pm. What effect these new rules will have on the gastronomic arts, as practiced in Paris, remains to be seen. (E. Weinberg)

Sea Echo Measurements at Shape Technical Centre

SHAPE Technical Centre (STC) is an organization composed of 350 civilian personnel drawn from the NATO nations and is located in The Hague, Netherlands. SHAPE Air Defence Technical Centre was established in 1955 to provide scientific and technical advice and assistance to SHAPE (Supreme Headquarters, Allied Powers, Europe) on air defense. The scope was expanded in 1963 to embrace technical advice and assistance on both air and ground defense and offence; its name was changed at that time.

The scientific program of the Centre originates in three ways: proposals for specific investigations are submitted by individual NATO nations, by SHAPE, or generated by personnel of the Centre itself. Assistance in establishing the annual STC program of work is provided to SACEUR (Supreme Commander Allied Powers Europe) by the Scientific Committee of National Representatives. The members of this Committee are scientists and engineers familiar with defense research and development in their respective countries. Each NATO nation has appointed a liaison officer, and the US position is presently held by Lt. Col. Allan F. Erwin, HQUSAF/AFRFD, Room 5D336, The Pentagon, Washington, D.C.

In 1968 STC is expected to move into its new building, but for the present the Centre is located in two separate places. One building houses management, the Operations Research Division, and the STC general purpose digital computer. The other building, located adjacent to RVO-TNO (a Netherlands government research laboratory), contains the Systems Research Division and the Communications Division, with their associated radar, data processing, and telecommunications laboratories.

According to Messrs J.P. Chaumont and A. Voss, measurements on average radar cross section per unit area, σ^o, of the sea have been under way at STC since the fall of 1965. At present only average values of echo are being measured, and the primary objective of the study is to obtain the percentages of time, on a long-term basis, that σ^o is expected to be between various levels. Effects of radar wavelength, polarization, and sea condition are being examined for angles near grazing incidence.

Six radars, on loan from the Netherlands Navy, are being used: two at L-band, three at S-band and one at X-band. The radars are all non-coherent pulsed types; some of the antennas are horizontally polarized and others are vertically polarized. The system parameters are as follows:

	L-Band	S-Band	X-Band
Azimuthal beamwidth	1.5°	3.3°	1.5°
Pulse length used	2 μs	0.5 μs	0.3 μs
Other pulse length available	5 μs	1.5 μs	0.1 μs

Calibration is obtained with "accurate" noise sources which are displayed on indicators with which return can be observed as a function of range. STC personnel estimate that σ^o obtained will be accurate to within 3 db.

The field-site geometry is such that the radars can look into the prevailing wave direction and perpendicular to that direction; because of various obstructions, the range of grazing angles available is limited to angles between 0.1° and 0.2°. Wave direction, wind speed and wind direction are being recorded. A wave height meter from which information is to be telemetered ashore is soon to be obtained.

Few, if any, absolute radar cross-section data are published on simultaneous measurements at L, S, and X bands and for 0.1° - 0.2° grazing angles. There are no reports available as yet on this program, but Chaumont estimates that data will be available by Fall of 1966. After this study is completed, STC personnel plan to make sea measurements with MTI radar. (M.W. Long)

Acoustical Yagi Antenna

Under the able direction of Prof. Irwin Meyer, the Third Physical Institute, University of Göttingen, Germany, has for 19 years been a leading center for experimental research in wave physics, with a strong emphasis on acoustics. Believing strongly in the unity of wave physics, Meyer has always encouraged research on electromagnetic waves, especially on phenomena that have their counterparts in acoustics.

Dr. R. Pottel heads the electromagnetic group which is currently studying absorbers (thin layers for broad-band performance) and transmission lines for electromagnetic waves and determining the electrical properties of electrolyte solutions and of solids. The electromagnetic group is well equipped for measurements from a few megacycles up to and including wave lengths as short as 4 mm. About 10 members of the Institute's professional staff of 40 are within the electromagnetic group; and the entire Institute staff numbers about 70. Each year four or five research students of the Institute receive the doctorate.

Dr. E.G. von Neumann has conducted extensive theoretical and experimental programs on the electromagnetic properties of dielectric-thread transmission lines, transmission lines of the Yagi type, and Yagi antennas. Based on analogies with the electromagnetic antenna, von Neumann has developed an acoustic Yagi antenna. Acoustic waves are propagated through a tube to air holes which are backed up by a reflector; metal discs serve as the Yagi elements. The arrangement effectively transforms sound waves into directional sound radiation and vice versa. Directional characteristics and gain have been determined (Acustica, 15, Issue 5, 1965) experimentally; the Yagi type acoustical transducer operates for frequencies between 8 and 12 kc, and over this band the

beamwidth is approximately 20°.

Von Neumann is currently writing a book on acoustics (to be published by Vieweg of Braunschweig, Germany) with Meyer, and paradoxically, except for the acoustical Yagi antenna, all his previous work has been with theoretical and experimental aspects of electromagnetic waves.

Von Neumann's papers on dielectric-thread and Yagi transmission lines have been published in Zeitschrift für angewandte Physik (Z. angew. Phys.). The dielectric-thread transmission line is a string of low-loss material, such as polystyrene, polyethylene, or quartz, with a free-space diameter of approximately a quarter wavelength. Such a transmission line is said to propagate the "dipole mode," because it is easy to launch such a surface wave with a dipole. The wave is loosely bound to the dielectric, and the field distribution is much like that for free space. Because most of the energy is transmitted outside of the string, the transmission loss is very low. Von Neumann has derived simple and tractable equations which describe the field in the vicinity of the thread, and has shown experimentally that his simplified equations are valid (Z. angew. Phys. 16, 452, 1964).

Transmission loss is so low that it must be measured with a cavity. A Fabry-Perot interferometer has been used for loss measurements at 5 mm, and the measured loss was only 0.1-dB per meter (Z. angew. Phys. 17, 304, 1964). The dipole mode is so lightly coupled to the string that severe loss exists at a bend, but a simple mirror can be used to create a low-loss bend. Tighter coupling to the thread can be accomplished by increasing thread diameter. In still another paper, von Neumann (Z. angew. Phys. 18, 71, 1964) discussed the practicality of gradually increasing the thread diameter in order to reduce loss around bends.

The external field distributions for a transmission line made of Yagi dipole elements, with spacing not exceeding a half wavelength, are the same as for the thread. Results of theory and experiment on the Yagi-type tranmission line have also been published (Z. angew. Phys. 19, 121, 1965). Propagation along a dielectric thread which passes through a hole in each of many metal plates has also been studied (Z. angew. Phys. 20, 57, 1965); because of the principle of Babinet, the mathematical problem is analogous to that for propagation along a dielectric thread on which are located equally-spaced metal discs. The Yagi-type transmission line has also been considered as a means of providing a transmission line suitable for making reflection coefficient measurements on absorbers. According to von Neumann, the method is not practical except for relatively large values of the reflection coefficient (Z. angew. Phys. 19, 297, 1965). Most of von Neumann's time is now being spent on preparing the acoustics book, but he is also completing a paper on the loss which exists between two closely-spaced and collinear dielectric threads (small gap).

There are two major facilities which help to illustrate the emphasis that Meyer places on pursuing the analogy between acoustic and electromagnetic waves. These large rooms, an anechoic room and a resonant chamber made for both acoustics and electromagnetic waves, were previously described by Ament (ONRL Report 40-60). For the resonant chamber, the Q at microwaves is approximately 2×10^6. While touring the building, it was learned that an analogy to a traveling-wave amplifier has been built with the wind tunnel -- turbulence for the slow-wave structure was made with slits. (M.W. Long)

Conference on Phonons

This Conference, sponsored by the Institute of Physics and The Physical Society, took place in Edinburgh, 6-7 April, about 2½ years after the International Conference on Lattice Dynamics in Copenhagen. To a certain extent it could be considered a smaller version of the Copenhagen conference. Of the 45 speakers listed in the program, 21 were associated with institutions in the UK, 9 from the US, and the rest from other countries. There were sessions devoted to lattice vibrations of imperfect crystals; lattice conductivity; phonon-photon interactions; lattice vibrations in covalent, metallic and disordered crystals; anharmonic effects; and spin waves.

Theoretical progress in the last few years on lattice vibrations in crystals with point imperfections was reviewed by Prof. C.W. McCombie (Univ. of Reading). It will be remembered that point imperfections introduce local changes in both the atomic mass and interatomic force constants and so modify the normal modes of the lattice. Straightforward procedures were outlined for obtaining information about the modifications to the modes produced by such local changes when the results of calculations of the normal modes of the perfect lattice are available. Such results are of interest in interpreting experimental results dealing with infrared absorption, vibronic transitions in electronic spectra, and thermal conductivity measured. Depending upon the particular situation, an experiment may reveal information about any or all of the following types of modes: (1) localized; (2) ordinary phonon or band and (3) non-localized or resonance. Localized modes are modes at new frequencies which appear on introduction of the imperfection in the perfect lattice. The quasi-localized or resonance modes appear in the frequency region of the ordinary phonon modes. As a result the data cannot always be analyzed in a straightforward manner.

Investigations of the vibrational structure of electronic transitions was discussed by several individuals. M.D. Sturge (Bell Telephone Labs.) showed whether the spectrum was characteristic of quasi-localized modes or ordinary phonon modes, depending on the coupling of the impurity atom to the lattice. A case where ordinary phonon modes were revealed quite nicely was shown by W.E. Bron (IBM Watson) on the case of Sm^{2+}:KBr. Theoretical treatments of the topic were presented by R.E. Hubner (Technische Hochschule, Stuttgart) and by J.V.D. Matthew and A. Hart-Davis (Univ. of York). The latter pointed out that quadratic effects in the electron-phonon interaction would lead to a broadening of the absorption associated with localized modes. Localized modes of Group III and Group V impurities in III-V compound semiconductors were reported by A.R. Goodwin, R.E.V. Chaddock, and S.D. Smith (Univ. of Reading). This choice of impurity and host lattice was advantageous in that free-carrier absorption was not as troublesome as in previous work by Smith's

group. Higher harmonics of the local mode frequency were observed, and this provides information about the anharmonic potential constants.

Infrared and Raman spectra associated with the lattice vibrations of perfect crystals were reviewed by F.A. Johnson (Royal Radar Establishment, Gt. Malvern, Worcs.). It was pointed out that in analyzing vibrational Raman spectra of multiphonon infrared spectra, it is often assumed as a first approximation that the coupling coefficient between the radiation and lattice vibrations is a slowly varying function of both the wave vector and phonon-band index in the absence of any known specific selection. While such a procedure is often useful in deducting the frequencies of various phonons, it cannot be employed as a useful measure of the intensity in any experimental situation. In particular, in recent months polarized laser Raman studies in GaP have provided extensive experimental data which can be compared with the infrared spectra. From this data it is inferred that the absorption intensity depends not only on the lattice vibration spectrum, but also on the band structure. Theoretical progress is being made on producing better quantitative estimates of the coupling coefficient and, thus, of the observed Raman or infrared spectrum. A number of other papers dealing with infrared and Raman spectra of pure crystals were presented.

The relation between the thermal conductivity and lattice vibrations was reviewed by R. Berman (Oxford). Unfortunately, several types of scattering processes may act simultaneously so that the frequency and temperature dependence of each are not generally known with certainty. Nevertheless, a number of important investigations on various materials have been carried out. In particular, this method has been useful in studying the isotope effect in LiF using ^{6}Li and ^{7}Li. It was noted that there have been some Russian investigations of the ^{3}He-^{4}He system. Various other papers on thermal conductivity in insulators and metals were presented. The zero-sound excitation in crystals of quartz and sapphire was the subject of a paper by J.N. Andrews, Jr., and M.W.P. Strandberg (MIT) describing an ingenious experiment. Such excitations are analogous to the zero-sound oscillation proposed by Landau for Fermi liquids.

Investigations of the lattice dynamics of solids as revealed by inelastic neutron scattering was discussed by A.D.B. Woods (Chalk River). Recent studies of the Kohn anomalies the dispersion curves of metals are of current interest. The lattice dynamics of niobium was given by R.I. Sharp (Cavendish Lab, Cambridge), and this agreed with the Chalk River investigations. In this case, the source of neutrons was a cold moderator providing a more intense beam of low-energy neutrons. This source was also used by G. Peckman (Univ. of Reading) along with a triple-axis spectrometer to study MgO. Dispersion curves for some metals were presented by W. Buhrer, T. Schneider, W. Glaser, and E. Stoll, in which the data were obtained by using a rotating crystal time-of-flight spectrometer at the Swiss Federal Institute for Reactor Research at Wuerenlingen.

In the realm of lattice dynamic calculations of perfect crystals, the latest calculations of J.R. Hardy (AERE, Harwell) and A.M. Karo (Livermore, Calif.) were given for polarizable ionic solids. Comparison with the infrared and Raman spectra were carried out where possible. The lattice dynamics of diatomic crystals with high dielectric constants (e.g., Tl halides, PbS, PbTe, SnTe) was discussed in a paper by E.R. Cowley, M.M. Elcombe and G.S. Pawley (Edinburgh). In addition to features which can be explained qualitatively in terms of conventional theories of ionic crystals, the dispersion curves of the three semiconductors show the effects of screening of the macroscopic electric field by conduction electrons.

Two experimental and two theoretical papers on spin waves were presented. The spin wave dispersion in $KMnF_3$ was determined at AERE, Harwell by S.J. Pickart (NOL, Silver Spring, Md.), M.F. Collins (AERE, Harwell) and C.G. Windsor (Harwell), and it was possible to deduce the nearest and next nearest neighbor exchange interactions and anisotropy field. Investigations of the spin-wave scattering of polarized neutrons from cobalt and nickel by A. Furrer, T. Schneider, and W. Halg (Wuerenlingen) provide information about the Fermi surface in these materials. However, there appears to be a discrepancy in the [111] direction between these measurements and those by optical, magnetoacoustic, and galvanomagnetic methods.

In this report only a few of many interesting papers have been mentioned. Although the subject of lattice vibrations can be considered a relatively old one in the field of solid state physics, there are still many interesting aspects of the subject on which active research is being pursued and for which there is evidence that this will continue in years to come. (M. Hass, NRL)

PSYCHOLOGICAL SCIENCES

Norwegian Institute for Applied Social Research

The Norwegian Government recently established an Institute for Applied Social Research (Institutt for Anvendt Sosialvitenskapelig Forskning) to fill a void in this applied field. While basic research in psychology and the social sciences certainly is as well established in Norway as in most European countries, there are a number of glaring deficiences in the applied field. For example, there are several institutes concerned with industrial psychology at the present time, but there is not a single group conducting large-scale studies either in the fields of school or clinical psychology. Moreover, while there is work on peace research and international conflict resolution, there is no research organization concerned with the domestic problems of the Norwegian population. The Institute for Applied Social Research has been established to fill this gap.

An advisory board has been appointed, and funds for the present calendar year have been appropriated even though no permanent director of the Institute has been appointed as yet. The advisory board or board of directors includes a number of eminent and professionally powerful individuals in Norwegian scientific, political, and university circles. In fact, if the stature of the board of directors is any indication of success, the Institute should make a major impact on the social and behavioral sciences within the foreseeable future. The composition

of the board is as follows:

E. Fjellbirkeland - Secretary of Norwegian Council on Scientific Policy (Chairman)
S. Lysgaard - Professor of Sociology, Oslo University
P.J. Bjerve - Director of Norwegian Central Statistical Register
R. Gerhardt - Director of Norwegian Military Psychology Institute (Representative of Norwegian Research Council on Science and Humanities)
Knut Mykland - Professor of History, University of Bergen
E. Rinde - Director of Institute for Social Research, Oslo
V. Aubert - Professor of Law and Sociology, University of Oslo

The above group has been quite active to date in formulating a basic structure for the Institute as well as guidelines for its operation. (Apparently none were given in the Government directive which established the organization.) No decision has been reached as to whether the activity of the organization will be fund-granting or contractual, as opposed to in-house in nature, or a combination of both. A critical aspect of this problem is the shortage of fully trained psychologists and sociologists in Norway.

Even though the basic structure of the Institute has not yet been decided, six projects have been accepted for grants in a broad category defined as "problems of the physically handicapped." These projects, all proposed by established Norwegian investigators, are concerned with the sociology, medical rehabilitation, and social psychology of the physically handicapped.

In the future it is hoped to expand the Institute program into the area of educational psychology. At the present time all innovations in Norwegian educational psychology reportedly must be adapted from programs of other countries, including the translation of psychological tests used in the school system. Although difficult to believe, it would appear that there is no capability at the present time in Norway to cross-validate tests on Norwegian populations. This is true, although it is clearly believed that there are cultural differences between Norway and the other Scandinavian countries for which the tests tend to be adapted.

The research sponsored by the new organization will be multidisciplinary in nature and will range from medicine to sociology. In fact, it would appear that the emphasis would be rather heavy in the area of medicine and social psychology, even though there is no physician and only one psychologist on the board of directors. (J.E. Rasmussen)

NEWS AND NOTES

Capshell, Royal Dutch Shell's experimental submersible pressure vessel has recently completed shallow water trials in the Mediterranean, 100 miles north of Rome. The next stage of this vessel's trials will be in deeper water, up to 600 ft, in the same area off the Monte Argentario. No official statements have yet been made on the results of the trials, but the London Financial Times reports that they are understood to have been successful. The Capshell operation simulates normal conditions for the upkeep of an offshore well-head on a Continental Shelf oil field, and the present trials have been to ascertain the behavior of the vessel on the sea bed and the reactions of the dozen divers who have been taking part. Physiological data obtained is being studied by Prof. A.A. Buhlmann of Zurich Univ., who is in charge of this aspect of the operation. Different types of breathing gases have been tested, together with different types of tools to ascertain those most suitable for work on the sea bed.

Denmark's Institute of Technology has recently opened a new acoustic laboratory valued at 8 million kroner ($1 = 6.9 Dkr). The Head of the establishment is Dr. Fritz Ingerslev. Within the laboratory, noise research is being carried out in two diametrically opposed areas. One of these areas consists of a room with very considerable resonance and the other comprises two rooms of "dead silence." The resonant room will be used to study and examine the quality of noise absorbing materials. Walls and ceilings are fabricated of reinforced concrete and equipped with remarkable convex "bubbles" which cause the noise to be thrown bac' in all directions. The acoustic quality is similar to that found in large churches. The "dead" rooms are so arranged that all possible noise is absorbed by the walls. One of these two rooms, probably the "best" in Europe, is covered with 10,000 pieces of 1.5-m-long strips of mineral wool, which effectively absorb 99.75% of the generated noise. (Extract from Berlingske Tidende, June 7, 1966, Denmark, quoted in American Embassy, Stockholm, Science News - Scandinavia, No. 4, 1966.)

The Chemical Society and the University of Nottingham have established a Chemical Society Research Unit in Information Dissemination and Retrieval at Nottingham. This Unit has been created to undertake research in areas complementary to those of the research program of the American Chemical Society's Chemical Abstracts Service.

A Grant of £35,000 from the Wellcome Trust to University College Hospital Medical School, London, to establish a Chair of Experimental Pathology, will lead to the return from the US of Dr. J.D. Judah, who formerly worked at the School. He has been Director and Prof. of Metabolic Research at Chicago Medical School since 1963. He will work here on the action of drugs in the body and the mechanism of cell injury in liver damage.

As a result of the death of Prof. H.G. Radden, Prof. Ernest Matthews has agreed to become temporary Dean of the Turner Dental School in the University of Manchester. Matthews is Prof. of Prosthetic Dentistry and Director of the Prosthetics Dept. in the School.

Prof. J. Brown, Professor of Electrical Engineering at University College, London, has been appointed to the Chair of Light Electrical Engineerin at the Imperial College of Science and Technology, London, as from 1 Oct 1967.

L. Castilleje, Lecturer in Theoretical Physics and Fellow of Wadham College, has been appointed to the second Chair of Physics at University College, London.

Dr. R. Nicholson will leave Cambridge Univ. in September for a Chair in Metallurgy at Manchester Univ.

Dr. P.B. Hirsch and Dr. M. Whelan leave the Cavendish Laboratory, Cambridge Univ., in September to become Professor and Reader, respectively, in the Department of Metallurgy at Oxford Univ.

Mr. N.L. Parr, recently Director, Metallurgy Division of the Admiralty Research Laboratory, Holton Heath (near Poole), Dorset, has been selected to be the new Director, Materials Research Dept (Naval), succeeding Mr. E.J. Vaughan, who has recently retired.

H. Charnock, Principal Scientific Officer in the National Institute of Oceanography, has been appointed to the Chair of Physical Oceanography in the Univ. of Southampton.

Prof. R.S. Silver, Professor of Mechanical Engineering in the Heriot-Watt Univ., Glasgow, has been appointed to the James Watt Chair of Mechanical Engineering, at that University.

Dr. T.D.V. Lawrie, an authority on heart diseases, who is a consultant physician and consultant cardiologist at the Royal Infirmary, Glasgow, has been appointed to the new Walton Chair of Medical Cardiology at the Univ. of Glasgow.

Dr. P.R. Bryant, presently principal scientific officer in the Telecommunications Research Laboratories of the General Electric Company, has been appointed to the Chair of Electronic Engineering in the School of Engineering Science, University College of North Wales, Bangor.

Dr. A.B. Foster, Reader at the Univ. of Birmingham, has been appointed to the Chair of Chemistry at the Institute of Cancer Research, from 1 Oct 66.

Prof. R.W. Tiffen, Prof. of Applied Mathematics at Birbeck College, has been appointed to the Chair of Mathematics at Birkbeck College from 1 Oct 66.

Dr. Brian Harris has returned after three-and-a-half years in the US with Pratt and Whitney, and will join the staff at the Univ. of Sussex this fall.

Dr. P. Beardmore, Lecturer in Metallurgy at Liverpool Univ., has taken a position on the scientific staff of Ford Scientific Laboratory, Detroit, Michigan.

Dr. W.J. McG. Tegart, Reader in Metallurgy at Sheffield Univ., has taken the Chair in Metallurgy at the Royal College of Aeronautics, Cranfield, which was vacated recently by Prof. A.J. Kennedy, who now heads the British Non-Ferrous Metals Research Association.

Dr. J.K. Lubbeck, a Lecturer in Engineering in Cambridge Univ., who is spending a year as Prof. of Advanced Engineering at Chulalongkorn Univ., Thailand, has been appointed to the recently founded additional Chair of Electrical Engineering at Cambridge Univ.

Dr. J.B. Adams, Director of the Culham Laboratory, Oxford has been appointed a full-time member of the UK Atomic Energy Authority for a period of five years from 1 Oct this year. He also becomes a member of the Advisory Council on Technology in the Ministry of Technology.

The title of Professor has been conferred on the following: Dr. F.F. Heymann, Reader in Physics at University College, London; Dr. Satya Prakash Datta, Professor of Medical Biochemistry at University College, London; Dr. R.M.H. McMinn, Professor of Anatomy at King's College, London; Dr. J.F.J. Dippy, Professor of Chemistry at the Chelsea College of Science and Technology, London; Dr. L.S. Bosanquet, Professor of Mathematics at University College, London; Dr. R.A. Kekwick, FRS, Professor of Biophysics, Lister Institute of Preventive Medicine, Univ. of London; Dr. S.J. Pirt, Professor of Microbiology, Queen Elizabeth College, London; and Dr. J.C. Sloper, Professor of Experimental Pathology, Charing Cross Hospital Medical School, London.

The death occurred in June of Prof. S.B. Watkins, who had been Professor of Chemical Engineering at King's College, London, since 1963.

Prof. F.A. Vening Meinesz, the distinguished Dutch geophysicist, died on 11 Aug.

Dr. Alan P. Goffe, the virologist, was lost at sea in a sailing accident earlier this month. He was Head of the Dept. of Experimental Cytology at the Wellcome Research Laboratories, Beckenham, only completed eight months ago for the research program which he had planned.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York, New York 09510.

ONRL-32-66	Applications of Fracture-Safe Design Concepts in the Development of Weldable Structural Steels in Europe by W.S. Pellini
ONRL-33-66	Experimental Physics in Israel. Part II. The Weizmann Institute of Science by Dr. I. Estermann
ONRL-34-66	Mathematical Activities in Israel by B. Epstein
ONRL-35-66	Notes on Psychological Training and Research in Yugoslavia by J.E. Rasmussen

ONRL-36-66 Some Nuclear Centers in France, Germany, Switzerland and Italy by J.G. Brennan

ONRL-37-66 Solid State physics in Scandinavia by B.O. Seraphin

ONRL-38-66 Inorganic Chemistry in Italy by S.Y. Tyree

The following conference reports are releasable to European scientists:

ONRL-C-13-66 Fifth International Symposium on Rarefied Gas Dynamics by I. Estermann

ONRL-C-14-66 International Union of Pure and Applied Chemistry (IUPAC) International Symposium on Macromolecular Chemistry, Prague by A.L. Powell

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Office of Naval Research, Branch Office London, England	2a. REPORT SECURITY CLASSIFICATION 2b. GROUP

3. REPORT TITLE

EUROPEAN SCIENTIFIC NOTES 20-8

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

N.A.

5. AUTHOR(S) (Last name, first name, initial)

Rasmussen, J.E. and Hewitson, Victoria, ed.

6. REPORT DATE	7a. TOTAL NO. OF PAGES 15	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO. N.A. b. PROJECT NO. c. N.A. d.	9a. ORIGINATOR'S REPORT NUMBER(S) ESN-20-8 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) N.A.	

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510.

11. SUPPLEMENTARY NOTES N.A.	12. SPONSORING MILITARY ACTIVITY N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473

UNCLASSIFIED

Security Classification

UNCLASSIFIED

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Biological Sciences Materials Sciences Physical Sciences Psychological Sciences						

INSTRUCTIONS

1. **ORIGINATING ACTIVITY:** Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. **REPORT SECURITY CLASSIFICATION:** Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. **GROUP:** Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. **REPORT TITLE:** Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. **DESCRIPTIVE NOTES:** If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. **AUTHOR(S):** Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. **REPORT DATE:** Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. **TOTAL NUMBER OF PAGES:** The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. **NUMBER OF REFERENCES:** Enter the total number of references cited in the report.

8a. **CONTRACT OR GRANT NUMBER:** If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. **PROJECT NUMBER:** Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. **ORIGINATOR'S REPORT NUMBER(S):** Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. **OTHER REPORT NUMBER(S):** If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. **AVAILABILITY/LIMITATION NOTICES:** Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. **SUPPLEMENTARY NOTES:** Use for additional explanatory notes.

12. **SPONSORING MILITARY ACTIVITY:** Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. **ABSTRACT:** Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. **KEY WORDS:** Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

UNCLASSIFIED

Security Classification

AD NUMBER: AD0803492

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 30 Sep 1966. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

No. 20-9
30 September 1966

Distributed by the
Office of Naval Research Branch Office,
London

BLANK PAGE

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

Edited by J.E. Rasmussen and Victoria S. Hewitson

30 September 1966 Vol. 20 No. 9

European Scientific Notes is Group II Newsletter type Class B periodical prepared and distributed by the Office of Naval Research London in accordance with NAVEXOS P-35.

(b) (6)

C. T. FROSCHER
Captain, U.S. Navy
Commanding Officer

AND NOT A DROP TO DRINK!

It would seem that one of the best ways of obtaining an index of the interest which ESN holds for our 7000 or so readers is to insert a request for obscure information. This fact came to light recently when one of our liaison scientists, Prof. S.Y. Tyree, included such a passing request for information in an article he wrote on Water Chemistry in Italy (ESN 20-6, 15 June 1966).

In presenting the chemical analysis of a commercially bottled mineral water in Italy, he included "Radioactivity ... 3.01 Mache units." This was followed by the parenthetic statement, "The scientific staff of ONRL will be grateful to anyone who can tell us what a Mache is." While the editors of ESN guarantee that this statement was not slipped in as a subtle technique for sampling reader response, they were at the same time delighted with the results which the statement elicited.

No attempt will be made to quote each of the letters received in response to Tyree's query. We were deeply impressed by the fact that at least two of our readers, having come across the Mache unit of measurement in the past, devoted considerable time and effort to running down forty- to fifty-year old publications in the archives of university and city libraries. Moreover, one was gracious enough to translate a portion of an early and somewhat obscure reference which was published in German. We were also very pleased to learn that each of our correspondents, while quoting from a number of different sources, sent us essentially the same if not identical definitions of the Mache unit. The definition, forwarded to us by the following correspondents: Prof. T.D. Brock, Dept. of Microbiology, Indiana Univ.; Dr. D.F. Gasbarri and E-8 D. Richard, U.S. Army Chemical Corps, Information and Liaison Office - Europe; Dr. P. Morrison, Dept. of Physics, Massachusetts Institute of Technology; Dr. E. Segrè, Dept. of Physics, Univ. of California, Berkeley; and Dr. P.F. Winternitz, Dept. of Chemical Engineering, New York Univ., is as follows: (Heinrich Mache, Austrian physicist) M.E. A unit of radioactive emanation. The quantity of emanation which produces a saturation current of one-thousandth of an electro-static unit. 1 curie = 2.8×10^{9} mache; 1 mache = 3.64×10^{-10} curie/liter = 3.64 eman. For those with an interest in pursuing the matter, the following references may be consulted:

Lehrbuch der praktischen Physik by Fr. Kohlrausch, Verlag Teuliner, Leipsig, 1913.

Zeitschrift für Balneologie, 6, 1, 1913.

Handbuch der Radiologie, ed. by Marx, pp 425-426, 1920.

Review of Modern Physics, 3, p 432, 1931.

Die Thermen von Baden, Eine Balneologische Monographie, by Munzel and Ulrich, Baden, Switzerland, 1947.

Hackh's Chemical Dictionary, third ed., ed. by Julius Grant, 1953.

In addition to contributing to one of ONR London's primary missions -- that of scientific information exchange -- Tyree's article also had a rather unexpected and quite positive pay-off. One of our correspondents indicates that the article on Water Chemistry in Italy has had a direct impact on his attitude toward and response to the newly-introduced New York City income tax. Thus, this correspondent reports having become reconciled to paying the first installment of this tax after visiting the annex of the New York City public library in search of a 1913 reference which would answer Tyree's inquiry. In reading this letter carefully, it would appear two factors contributed to our correspondent's change of heart. Even though the relative importance of these two factors may be reversed: (1) He was, in fact, able to find the journal for which he was searching, and (2) the volume was handed to him by a "smiling, pretty girl."

For the record it should be noted that another of our correspondents does not agree with Tyree's highly subjective ranking of Italian waters in terms of gustatory appeal. In this connection the following information is quoted directly:

> "Finally, I cannot at all agree with Mr. Tyree. Italian tap waters can be delicious, and they are far pleasanter than Cambridge dilute chlorine solution, but surely they cannot compare with the tart, tingling sparkle of San Pelligrino (the brand of water which is responsible for this correspondence). And the physical chemistry and dynamics of the bubbles add more pleasure yet. Evviva San Pelligrino è Professore Bonino!"

AEROSPACE SCIENCES

The Exhibition of the British Aerospace Industry

One might consider the keynotes of this year's display of the British Aerospace Industry as international cooperation and export. The joint British-French supersonic transport Concorde is, of course, the primary example of cooperation; while the importance of the BAC 1-11 as the largest dollar earner laid emphasis on the export potential of the industry.

If one saw only the flying display, these factors would be quite evident. From the export standpoint, the potential of the short-haul, light transport was exemplified by such aircraft as the Short "Skyvan" (shortly off to Australia) and the Britten-Norman Islander. The latter was also an example of the elusive incentive that is thought lacking in this country by the press. The announcer noted that the workers at the factory had postponed their vacation in order that both the prototype and the first production model be at the display. Another outstanding example of an aircraft with export potential was the Hawker-Siddeley "125" 6-passenger executive transport. The flying capability of this aircraft was proven in a convincing way.

The joint-cooperative aspect of the display often showed the cooperation between countries other than Britain as in the Brequet "Atlantic" joint German-French reconnaissance aircraft, and the "Transall" C.160 passenger/freighter that is built by a consortium of continental aircraft engineers. One should add that these and other cooperative aircraft in the display were all powered by British engines - a further aspect of the export potential of the industry.

To the casual observer, the most remarkable performer in the flying display was the Hawker-Siddeley P.1127 V/STOL close-support reconnaissance aircraft. After showing its short takeoff capability and maneuverability at high subsonic speeds, the aircraft performed the transition from forward to vertical (and then to sideways and reverse) flight. The "Kestral" version of the aircraft was also displayed.

One was again reminded of the Concorde with the flyover of the BAC 221 delta-wing jet aircraft. This is currently fitted with the "ogee" wing of the Concorde design and is undergoing tests at the Royal Aircraft establishment at Bedford.

In the display pavilion, the structure of the Aerospace Industry was revealed in the floor plan. The booths of manufacturers of auxiliary equipment were arranged in a symmetrical pattern so as to enclose the central display of the major air frame companies - British Aircraft Corp. and Hawker-Siddeley. Also adjacent were the two major engine manufacturers - Bristol Siddeley and Rolls-Royce. Westland, Short Bros., Handley-Page, Scottish Aviation and Beagle were given a prominent position near the entrance.

The central display of BAC was the Concorde - a large transparent plastic model about 20 ft in length. It was left for the Queen to see the full-size Concorde fuselage when she visited the Filton, Bristol, works during the display after opening the Severn Bridge.

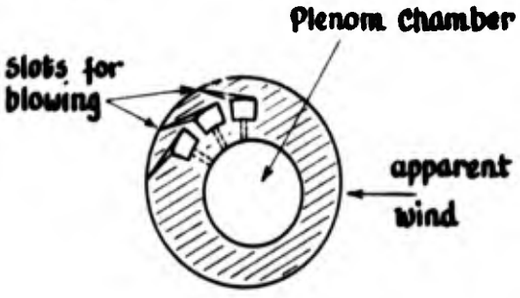
Bristol-Siddeley had a full-size model of the "Olympus" which will power the Concorde. There was also a very elaborate visual demonstration on a screen of the various configurations of the inlet and outlet to the engine during the many phases of flight. Among many other engines on display was a full-size model of the "Pegasus" ducted-fan turbo-jet that powers the P.1127. This was very helpful in attempting to understand how the P.1127 is maneuvered.

The Rolls-Royce display was of comparable interest. Most of the engines currently in use were on display, including a number of lift-jets in use here and abroad. Of particular importance to the casual observer was the demonstration model of the gas turbine in which the blades were of fiber-reinforced plastic. There was also an interesting display of air-cooled turbine blades from many of the current Rolls-Royce models.

The Ministry of Aviation had several very interesting displays. One that was attracting considerable attention was a rigid lifting rotor. This had the appearance of a helicopter which had a 12-ft section of about a 3-in diameter pipe in place of its aerofoil-shaped rotor. It was suggested by means of models and in print that this type of rotor might enable current jet aircraft to acquire VTOL characteristics. (This takes on some significance after one reads the article by Basil Arkell in the recent "Times" Survey of British Aviation entitled "High-Speed Helicopters."

In this article he challenges the industry to reassemble those engineers who worked on the abandoned "Rotodyne" project and in turn challenged Lockheed which is currently developing a high-speed helicopter.)

Lift is produced by blowing air tangentially on the upper surface of the rotor from span-wise slots (see Figure). The rotation of the rotor is accomplished by air flowing through inclined vanes at the rotor tips. A jet-powered vehicle acting as a test bed for the rotor was also on display. Apparently this is used to augment wind tunnel tests. This work is being undertaken at the National Gas Turbine Establishment.



Cross-Section of Rigid Rotor

The Royal Aircraft Establishment, Farnborough, had a display of "Carbon Fiber Reinforcement of Structural Plastics." By embedding fibers of graphite about 6 μ in diameter in a plastic, one is able to develop a Young's modulus of 60 X 10^6 psi. A display of tip-loaded cantilevers showed that the flexural rigidity of a beam of reinforced plastic was greater than that of a comparable beam of aluminum.

The Royal Aircraft Establishment, Bedford, exhibited the results of their design and evaluation of the Concorde air intake. Graphs were available showing (1) the effect of changes in the shape of the wall which divides the two ducts (in a given nacelle) on pressure recovery and amplitude of oscillatory pressures, (2) the relative insensitivity of both inboard and outboard ducts to throttling, in turn, of its neighbor, and (3) the effect of immersing the intake into the wing boundary layer.

Suffice it to say that these were but a few of the many interesting exhibits, and represent only the highlights for a particular viewer. (H.E. Williams)

MATERIALS SCIENCES

Fuel Cell Development at ASEA

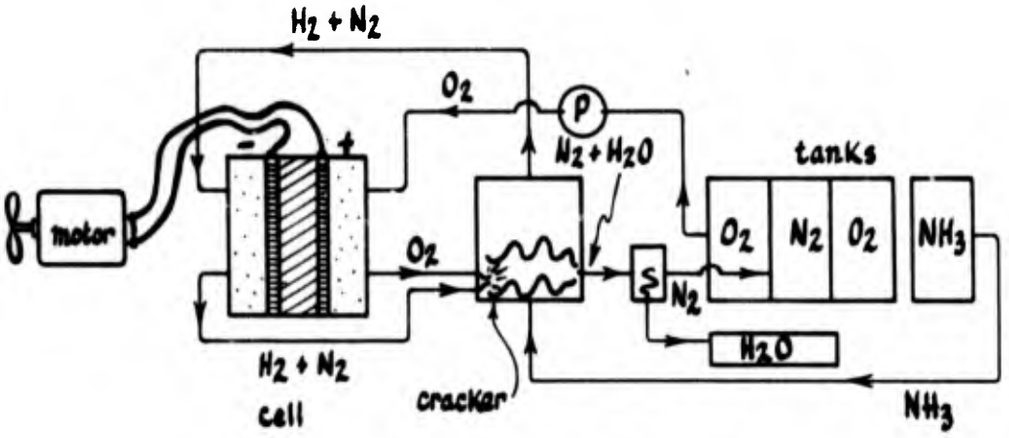
Allmanna Svenska Electrinska Actiabolaget (ASEA) of Sweden - the "General Electric" of Scandinavia - is capitalized at about $75 million with 34,000 employees. Organized in 1883, ASEA is now the largest manufacturer of heavy electrical equipment in northern Europe. It consists of mechanical, electrical, and chemical divisions. The company has main manufacturing plants in Vasteras, Ludvika, and Halsingborg, and smaller plants in other Swedish towns and in Australia, Brazil, France, Mexico, Norway, South Africa, and West Germany. The organization is considered progressive for a heavy industry. It has in the past established itself as a world leader in several new fields of electrical conversion and transmission by developing unique capabilities brought about by exploiting its rather large research investment for a European firm.

The ASEA Central Research Laboratory located in Vasteras near the group's main headquarters employs 400 engineers and scientists. Fuel cell research is conducted through the laboratory's Physics and Chemistry Division, although Dr. Olle Lindstrom, who acts as the fuel cell project leader, is also the Director of the entire Central Laboratory. Research on fuel cells started at ASEA in 1960 and now represents the largest fuel cell effort in Europe: 70 full-time employees (including 20 in thermal engineering, 15 in electrode development, 15 in manufacturing, and 10 in component testing).

The principal fuel cell effort at ASEA is exerted toward developing, manufacturing, assembling, and testing components for the 200-kW prototype power plant. Research on high temperature electrodes and electrode thermodynamics is being conducted by several individual researchers at a lower level of effort.

200-kW Power Plant - The system: ASEA Central Laboratory is constructing the largest fuel cell power plant ever built -- a 200 kW unit -- larger by a factor of ten than any known competitor. Liquid ammonia and liquid oxygen are the reactants for the prototype. The ammonia is cracked into its gaseous components, hydrogen and nitrogen, prior to reaching the cell. The nitrogen is later used as a pressurizing agent. Water is removed while

processing the electrodyte. The schematic diagram indicates the flow of reactants.



Schematic ASEA Fuel Cell Power Plant

The Cell - The cells employ dual-porosity nickel electrodes and a 35%-KOH electrolyte, operating at about 70 psi and 80°C. The electrodes are 200 mm in diameter with current density expected to be about 170 mA/cm^2 at 700 mV. This gives an output of over 35W per cell. Cells will be built into submodules of about 1 kW each, submodules then built into larger modules each of 25 kW, and eight of these modules compose the 200 kW plant. The electrolyte is circulated and reconditioned. The anodic catalyst is nickel-boride; the cathodic catalyst, silver. There is a cutoff in the current density at about 170 mA/cm^2 at which an increase in surface area does not bring about a further increase in current density. This is due to mass transfer problems on the surface of the electrodes. The chosen current density constitues an operational compromise, as cell characteristics of 280 mA/cm^2 at -0.66V have been reached in the research laboratory. Current leakage within a cell is about 0.5 mA/cm^2.

The Cracker - Liquid ammonia is pumped through a cracker in which it is broken down into hydrogen and nitrogen gas at an elevated temperature. The reaction starts at 600°C and operates best at 800°C with hot spots as high as 900°C. 600°C is the minimum cracking temperature for NH_3. For a reasonable yield 800°C is chosen as the operating temperature. At this temperature, only 0.012% NH_3 is left uncracked. The output mixture is then passed through the anode plenum in which most of the hydrogen is removed to flow through the cell. The diluted mixture is returned to the cracker. There the residual hydrogen is burned with oxygen surplus from the cathodic plenum. Of the hydrogen formed, about 20% is used for fuel heating and cracking and about 80% is utilized for producing electrity. To start the cracker, pure ammonia is burned. A catalyst to inhibit the formation of nitrogen oxides is present. The initial start-up requires three hours. The ammonia cracker is a modified standard model made for the chemical industry by Mahlert, Stuttgart.

ASEA personnel claim a bulk purchase price for NH_3 at 6-7¢/kg to be attainable. They further claim that the present utilization rate for ammonia is 0.35-0.40 kg of NH_3/kWh in their system.

Assembly and Test - Electrodes are pressed, sintered under cracked-ammonia atmosphere, tested, sealed in a plastic frame which contains passages for gases and electrolytes, and given a final tightness test. The processes are proprietary. The production rate is several hundred cells per day. The rejection rate, as in many powder metallurgical processes, is reasonably high.

After assembly and checkout, an

extensive test period of several months is planned. It is anticipated that tests will be completed sometime during 1967.

Several published articles on fuel cell development by Dr. Lindstrom of ASEA have appeared, i.e., (a) "Fuel Cells," ASEA Journal, 37 (1964): 1, pp 3-8; (b) "Fuel Cells," FOA Orienterar Om, 5 (April 1966) pp 24-29 (original in Swedish, English translation available ONRL). (B.I.Edelson and B. Bartocha)

Fuel Cell Research at Siemens

The research laboratory of Siemens-Schuckert Werke A.G. near Erlangen, Germany, would certainly place a Southern-Californian at his ease. With its alternate and separate low and high-rise, glass, steel and concrete structures surrounding grassy parks and landscaped pools in an appropriate rural atmosphere, an architectural entity is created sufficient to fool a visitor. One half expects to see the "US-101" route signs nearby.

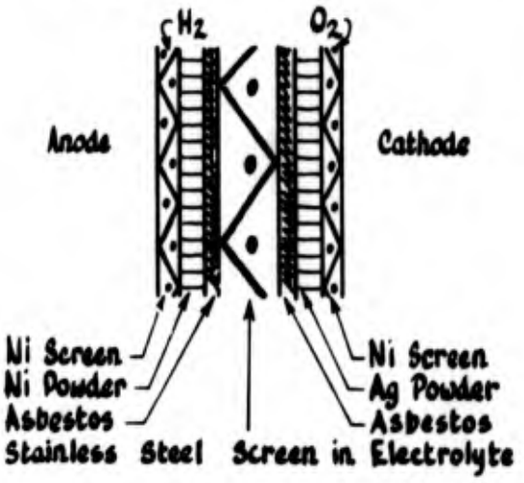
The laboratory is modern in every respect, and its research policy appears to have a reasonable mixture of unfettered research and applied development. Its fuel cell research program runs this gamut. Dr.Ferdinand von Sturm, heads the Fuel Cell Division, which appears to number over a dozen full-time researchers. The division operates with the Chemistry Department under Herr Evencheck.

Fuel cell development work at Siemens has been entirely a company-sponsored effort. Von Sturm started the research about four years ago. They have done basic research on fuel cell chemistry, materials and thermodynamics, and have developed some fuel cell components. They have subjected a number of components to long life-time tests.

Siemens' effort has been concentrated on low-temperature (less than 100°C) and medium-temperature (up to 250°C) systems, using both porous and non-porous electrodes. Several new and interesting electrodes and cells have been developed and tested:

(a) Raney nickel and carbonyl nickel electrodes of the DSK type. These have been made 3 to 4 mm thick, with some successful electrodes 1 mm thick. Great difficulty has been encountered with homogeneity in the thinner electrodes.

(b) Gestutze (supported) electrodes. These represent what is believed to be a unique development. The electrodes consist of a thin mechanically unstable porous sheet supported by metal screens. The sheets are unsintered powder, nickel on the anode side, silver on the cathode side. Asbestos sheets provide porosity and support between the powder and the circulated alkaline electrolyte. (Fiberglass replaces asbestos in acid electrolyte systems.) Electrodes have been made of areas 10, 30, and 2500 cm^2. These cells operated at about 5 atm, 50° to 60°C, obtaining about 30-50 mA/cm^2. One 500-watt battery, using the medium size cells, was built and used to power a small boat for demonstration purposes. The largest size cell has been under test for over a year. It has attained a current density of as high as 200 mA/cm^2, but normally maintains about 50 mA/cm^2. (This is about 100-watts constant output per cell.)



Gestützte Electroden

(c) Palladium foil electrodes in both sheet and tube form. These non-porous electrodes pass hydrogen by diffusion rather than by seepage. Using either hydrogen or methanol at 275°C, they have obtained current densities of several hundred mA/cm^2. The foil can be manufactured 0.15 mm thick, and an attempt is being made to produce it 0.05 mm thick. Some trouble has been encountered in embrittlement and cracking by formation of a palladium hydride.

(d) For small cells (less than 1 kW) Siemens has developed some power storage devices which contain an alcohol fuel dissolved in an alkaline electrolyte. Atmospheric air is the oxidant. These cells are reliable

over many years. Some four-year old cells can be recharged and reused.

Siemens has only recently given thought to applications of very large fuel cell systems. They are prepared to build a plant of 100 kW or so, and have, in fact, written proposals for US and foreign contractors for several such plants. No awards, though.

Studies and preliminary designs have been prepared for even larger plants. In such plants they would employ liquid hydrogen and liquid oxygen as reactants with their gestützte electrodes. They might consider using sulphur-free diesel oil, gasoline, or methanol if the customer preferred. Siemens prefers the cryogenic liquid reactants for simplicity's and efficiency's sake. They also brought out the interesting point that reformers require the handling of gaseous hydrogen at high temperatures in many small tubes and this may be more dangerous than handling cryogenic liquids. They added also that reformers cannot handle power surges very well.

An excellent review of the Siemens work is available: F.v. Sturm: "Electrodes in Fuel Cells," Siemens Review, March 1966, pp 118-124. (B.I.Edelson)

The International Union of Crystallography Meetings, Moscow, July 1966

The International Union of Crystallography was founded twenty years ago to re-establish the lines of communication among the world's crystallographers following World War II. Among its founders were Sir Lawrence Bragg, Max Von Laue and Paul Ewald: the name "Acta Crystallographica" was suggested by the Russians for its journal. Beginning in the US in 1948, its triennial General Assembly, International Congress and Symposium has been held in Sweden, France, Canada, United Kingdom, Italy and this year in Russia at the invitation of the Academy of Sciences of the USSR; the 1969 meetings are rumored to be scheduled for Stony Brook, Long Island. In addition, topical conferences, such as the one celebrating the 50th Anniversary of X-ray Diffraction held in Munich in 1962, have been sponsored wholly or in part by the IUC.

Of all the fields of science, one of the ones which needs no justification, explanation or apology for having its most important meeting in Moscow is that of crystallography, crystal physics, and crystal chemistry. Indeed, many of the works and articles of Zhdanov, Belov, Shubnikov, Vainshtein, Pinsker, and Chernov on crystal physics, symmetry groups, electron diffraction, and crystal growth have been translated into English and are considered to be authoritative accounts in their areas. Not only is the quality of the Russian work recognized as being high, but the size of the effort and number of people involved in the many institutes is staggering.

The Russian contribution was a major factor in the more than 50% increase in the number of pages of abstracts from 204 at the 1963 Rome meeting to 321 at this one, and swamped the normal monotonic increase in scientific activity and participation in international meetings. Fifteen hundred of the delegates -- one-half of the total -- were from institutes within the USSR. In addition, the Deutsche Demokratische Republik (East German) contingent of 115 was only exceeded in size by that from the UK (200) and the USA (175), and was almost twice the number from the West German Bundesrepublic and West Berlin (listed separately). There were substantial numbers of scientists from Czechoslovakia (65), Hungary (55), Poland (30), as well as France and Italy; in all, there were 3,000 active delegates from 34 countries.

The inaugural session on Tuesday, 12 July, was held in the 6000-seat auditorium of the beautiful modern, air-conditioned Kremlin Palace of Congresses, where "Swan Lake" was presented by the Bolshoi Ballet Company for all participants that evening and where the Congress banquet was held toward the end of the meeting. All scientific sessions were conducted in the enormous Moscow State University Main Building and the nearby Physics Building. The more than 950 papers were divided into 21 divisions - 17 during the five days designated as the "Congress of Crystallography" and four during the two days immediately following, set aside as the "Symposium on Crystal Growth." A listing of these divisions will emphasize that in many European countries, and especially in Russia, crystallography includes what we would call crystal and solid state physics, crystal chemistry and parts of related fields such as geology, mineralogy, metallurgy and ceramics: theory of structure analysis (28); theory of diffraction of X-rays, neutrons and electrons (48); symmetry in

its relation to crystalline structure (17); dynamics of crystalline structure, force-field theory (17); structure of inorganic compounds, including minerals (112); structure of metals and alloys (57); magnetic structures (33); structure of organic compounds (108); structure of coordination compounds (71); structure of proteins (44); types of breakdown of ideal structure of crystals, dislocations (78); structure and properties of crystals in the field of phase transitions (68); apparatus and techniques for crystallography (49); computing (12); partly ordered structures (46); thermal motion of atoms and molecules (19); miscellaneous topics (24); external and internal morphology and mechanism of crystal growth in their relation to crystallization conditions (30); the effect of impurities on crystal growth, adsorption, impurity capture, connection between crystal and impurity structures (30); epitaxy, structural and crystal-chemical correspondence of growing surfaces, auto-epitaxio overgrowth (films) (37); miscellaneous topics (34). The divisions were arbitrary and there was considerable overlap; many of the papers could have equally well been in more than one division or category. Thus, the numbers following each topic which refer to the number of papers in each division only give a rough idea of the relative amount of effort in each of these areas reported at the meeting.

A 50-minute invited general lecture proceded each of the five Congress morning sessions. The first of these was called The Congress Discourse and was on "Antisymmetry" by A.V.Shubnikov (Inst. of Crystallography, Academy of Sciences of the USSR, Moscow). The others were "Electron-deficient Valences in Crystal Structures" by W.N.Lipscomb (Harvard University), "Problems in Organic Crystal Physics" by A.I. Kitajgorodskij (Inst. of Elementoorganic Compounds, Academy of Sciences of the USSR), "New Ideas on Isomorphous Replacements" by N.V.Belov (Inst. of Crystallography, Academy of Sciences of the USSR), and "Investigations of Biological Systems by X-ray Diffraction and Electron Microscopy" by H.E.Huxley (Medical Research Council, Laboratory of Molecular Biology, Hills Road, Cambridge, England). An additional general lecture on "Anomalous Dispersion as a Tool in Structure Determination" was delivered by G.N.Ramachandran (Centre of Advanced Study in Biophysics and Crystallography, University of Madras, India).

All of these lectures were presented in the Assembly Hall of the Moscow State University and were simultaneously translated into the official languages of the Congress: English, French, German, Russian. The eight or nine short (15 minute) contributions in each of the nine half-day sessions of the Congress were not simultaneously translated; authors were requested to have legends and captions on slides in Russian and one of the Congress languages and to prepare slides of the explanatory text (which were projected by a second projector) in Russian if the paper was to be read in English, French, or German; the Russian authors were instructed to prepare accompanying text slides in English. This worked out satisfactorily in most cases though there were some annoying exceptions. Interpreters were present at each session and in general were very helpful during the discussions.

This meeting suffered as all large meetings do from the necessity of having simultaneous sessions... on most days there were as many as 13 sets of papers being presented at once! Since session chairmen did not always adhere strictly to the published time schedule, it was almost impossible to hear papers in more than one session. In this particular case, the very conditions contributing to this discouraging situation also provided the more than compensating factor, viz., the unique occasion to meet and discuss work with investigators most of whom one would have had a vanishingly small chance of meeting anywhere else, and the opportunity to visit laboratories and see facilities and research in progress. Thus, I feel that this meeting, in spite of its obvious limitations, was a success, and suspect the experience of many visitors will parallel my own described briefly below.

The sessions of Division 12 on Phase Transitions included papers on the theory of phase transitions; martensitic transformations; defects and lattice distortions during transformations; ferroelectric, piezoelectric, and antiferromagnetic transformations; order-disorder transformations, kinetics of precipitation; radiation damage and other influences on transformations; and the many techniques of studying transformations. The sessions which included predominantly Russian papers were very well attended by the Russians.

Many of the papers were by women, and half of the audience in these sessions were women who participated actively in the discussions; M.I. Zakharova (Moscow State University Physics Department) chaired one of the transformation sessions, for example. I found the discussions out in the corridors and at lunch with L.A. Shuvalov (Inst. of Crystallography, Moscow), K.Aleksandrov (Dept. of Physics, Siberian Dept. Aca. of Sci., Krasnjarsk), A.Khandras (Inst. of Metal Physics, Kiev) and A. Roitburd and V.J. Izotov (Inst. of Metal Physics, Moscow) on the relationship between martensitic transformations and ferroelectricity, transformations in Cu-Al-Ni alloys, the theory of martensitic transformations, and electron microscopic evidence of partially twinned martensite, professionally and personally more stimulating and rewarding than the discussions in the sessions where I was chairman, author or participant.

The opportunity to see laboratories and work in progress was a very important phase of the Moscow meeting, and some Congress participants did make such visits in response to invitations from Russian colleagues. In addition, excursions to physics, X-ray, crystallogenesis, semiconductor, ferro electric, and plasticity laboratories at the Kiev Institute of Physics of the Ukranian SSR Academy of Science and at the Plekhanov Mining Inst., the Leningrad State University, the Inst. of Semiconductors and the Ioffe Inst. of Physical Engineering in Leningrad were arranged by Intourist before and after the Congress. During the Congress arrangements could be made for visits to any of the 40 laboratories in nine of the numerous institutes in Moscow, including 14 laboratories in the famous USSR Academy of Science Institute of Crystallography which is so well known for its research in X-ray and electron structure analysis of minerals and proteins, studies of ferrites and dielectrics, work on mechanical properties of single crystals and dislocations, and its extensive program in crystal growth and synthesis.

On the Monday preceding the opening of the Congress, I had been invited by Academician Kurdjumov to visit his institute, and I spent a most profitable and enjoyable time with him and his co-workers discussing martensitic transformations and other research areas. Kurdjumov, who is still very active, presides over the Institute of Metal Physics of Moscow which includes among its staff of 200, 50 with PhD's, five of professorial status and others working toward the "Candidate" qualification, as well as technicians. While this Institute is an order of magnitude smaller than the three other constituent institutes of the Central Scientific Research Institute of Ferrous Metallurgy in Moscow, its activities are much more oriented toward fundamental speculative research than its sister institutes, The Institute of Steels & Ferrous Alloys, The Institute of Precision (Special) Alloys, and the Institute of New Technical Processes for Metals and Alloys. Here, as well as at the Department of Physics laboratories at the Moscow State University which I visited on Saturday on a group tour, I was impressed with the high quality of some of the transmission electron micrographs obtained with the Russian 100-kV instrument which showed, for example, dislocation interactions in metal and non-metallic systems and partially twinned martensite plates. Among the standard (Russian) X-ray apparati was a Japanese Lang camera; many kinds of crystal growing equipment for the production of ferroelectric crystals, etc., could be seen. Again, a substantial fraction of the scientists (not just technicians) in the laboratories were women.

The exhibit of crystallographic apparati, other research equipment, and synthetic crystals was held in the Sun Pavillion of the Central Stadium Luzhniki across the Moscow River from the University; exhibitions of books and photographs of crystals were displayed during the conference period. Frequent bus service to the University and Stadium from the several large Intourist Hotels in which the participants were comfortably housed was provided by the local Organizing Committee, which also drew up an extensive excursion program to the many attractions of Moscow and environs, as well as a Ladies Program. American delegates had an additional opportunity to meet Soviet scientists socially at a reception given by US Ambassador Kohler and his wife at their residence. I hope that we can make the 1969 meeting as stimulating and interesting an experience for our foreign guests as this one was in spite of its large size, and that we can provide the opportunity for our younger scientists to participate in such international meetings as the British do -- a substantial number of the UK delegates in

Moscow were young, enthusiastic men and women who were close to completing their doctoral research or who had just received their PhD's.
(D.S. Lieberman)

Metal Physics at Battersea College of Technology

The group involved in "metal physics" at Battersea is perhaps misnamed. Although a part of the Physics Dept., it is clearly developing as a "materials research center." The nucleus of a polymer section has been started, and this group is concerned primarily with the mechanical behavior of polymers. Dr. J.G. Rider (Senior Lecturer) worked last year with Dr. A. Keller at the University of Bristol, and is now continuing his studies on deformation of polyethylene at Battersea. Dr. T. Hinton (Senior Research Fellow) is now involved in a research program with Keller, after which he will join Rider.

Dr. A. Crocker (Reader) has been calculating the energies of small dislocation loops. His results indicate considerable sensitivity to the orientation and shape of the loop. He is, of course, continuing his work on the application of matrix theory to phase transformations. Recently he has developed a procedure for predicting twinning elements. The basic physical argument consists of calculating the shear associated with all possible twinning reactions, the only requisite being that the new unit cell be one that was possible in the original structure; but there are not necessarily any mirror relationships involved.

In connection with these theoretical studies, some quite interesting experimental work was done with Hg. One of the predicted twinning systems for this material was found to be present and predominant, and indeed this was a Type-II twin. This is the first time that such a twin (with an irrational twin plane) has been found to be the predominant mode. Although Crocker had predicted this possibility, it is not the mode with the smallest shear. Such a twinning system presents a number of problems. First, what is the nature of the interface with an irrational plane? Second, the dislocation reactions for glide on this plane must be unusual as they obviously cannot involve dislocations on the slip plane. Crocker is thinking about both of these problems. Serious problems for dislocation theory are not only caused by this twinning mode but also by the atomic shuffles involved in some crystals. (In fact, there have been no observations in any crystals of any of the proposed dislocation configurations for producing a twin. Is it possible that this is a mode of deformation without these defects -- a nasty bit of heresy, some of you readers will say, I imagine!)

Crocker and co-workers have also found that the predominant slip in Hg occurs on the close-packed plane -- not on [100] as previously reported, but in the second most close-packed direction $[1\bar{1}0]$. Near the melting point there is also some wavy slip involving the close-packed direction [110]. In a recent analysis of stacking faults in Hg (Phys. Stat. Sol. 10, 141 (1965)), it was shown that there was a large reduction in the line energy when partials form from dislocations with $[1\bar{1}0]$ Burger's vectors, but the partials for the [110] dislocation are almost perpendicular. As a result their interaction is quite small and cross-slip likely. This explains the waviness with the [110] slip direction and the straight slip with the $[1\bar{1}0]$ slip direction.

The question remained as to why the second most close-packed direction is the slip direction, and why the unusual Type-II twinning system occured. Calculations of the shear moduli in various directions have just been completed. By use of a criterion of either fixed stress for twinning or a fixed strain, it turns out that this constant is lowest for the observed twinning and slip systems!

Under Rider, theoretical calculations have begun on the resistivity due to dislocations. Departing from previous models, which have considered either the long-range stress field only or a core of "bad" material, they are calculating the effect due to the displacement of planes on either side of the dislocation. Bicrystals involving simple twist and tilt boundaries are being prepared, and the resistivity tensor will be measured. The new model suggests, for example, that conduction along the plane containing an edge dislocation will not be affected.

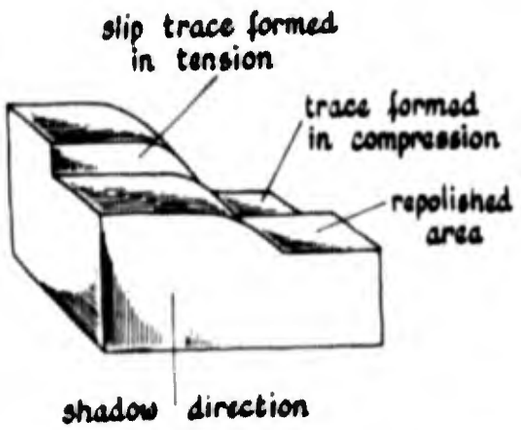
Dr. Keith Puttick (Reader) has been working on his unusual discovery of kinking of Cd in tension. The two kink walls consist of cells and arrays of dislocations of opposite sign.

Unusual regions have been discovered within the kink, misoriented by as much as 90°.

Other work in the group includes studies of lattice thermal conductivities, magnetoresistivity, Type II superconductors, cyclotron resonance, magneto-optic effects, and thermodynamics of solid-rare gases.

Under Dr. P. Charsley, some interesting studies have been made of the deformation of Cu-Al alloys. Previous work by Koppenaal and Koppenaal and Fine (Trans. Met. Soc. AIME, 1963, 227, p. 257; ibid, 1961, 221, p. 1178) indicated that all the strain in a single crystal did not seem to be accounted for by the displacements of the slip traces that were observable optically. Charsley's group, using replication techniques, have found that the additional strain is on slip planes in the region behind the Lüder's band, and not ahead of it. Further, the strain increases in this region as the band moves beyond it. They have also obtained striking evidence that during reverse loading, most of the initial strain is on the same slip planes (in reverse shear) until the stress exceeds that applied in tension. Above this load, nearby planes become active. The technique used is illustrated in the figure below. After tensile deformation, and replication, one region is repolished, deformed in compression, and replicated again. By shadowing the two replicas in the same direction, the traces formed in tension will be, say, light, and those formed in compression will be dark. By comparing how these regions join, the active traces can be pinpointed.

Comparison of the two replicas gives information on the amount of reverse shear as well.



(J.B. Cohen)

Materials Science at General Electric Co., Ltd., Hirst Research Centre

Although there is no connection whatsoever between this company and its namesake in the US, the interests of the two firms are quite similar. (In fact, the lawyers of the two firms are getting to know each other quite well in a trademark action now under way!) The Hirst Centre, at Wembley, Middlesex, consists of a large central laboratory and several smaller laboratories "owned" and controlled by certain producing divisions. In this way, each division retains its own research group, and yet, through being in the vicinity of a large research complex, derives all benefits from exchanges, equipment, and so on.

The total staff is about 1000, of whom 400 are professionals. This is about one-third the level obtained in the early 1950's, but the reduction has really only elimated most of the pilot plant operations that were in full swing then. Groups within the laboratory are encouraged to seek outside support from the government and from other companies as well.

Dr. D.S. Evans has been studying ways of making tungsten or its alloys by powder metallurgy techniques. It has been found that small additions of palladium sharply increase the sintering rate, at temperatures well below those at which any liquid phase would be present. On alloying with about 10% Cr, and as soon as the composition of Pd exceeds about 0.03%, a Pd-rich phase appears and oxidation resistance is markedly improved. Life is 1000 hours at 1200°C, or 50 hours at 1400°C! The exact role of the Pd in sintering, or of its second phase in preventing oxidation, is not at all clear yet. It is felt that both coat the W powder particles, but no evidence for this has been obtained.

Mr. D.R. Evans has been obtaining high purity refractory metals (<1 ppm O_2) with electron-beam melting and zone refining techniques. He has also been comparing coatings of W and Mo on Ti, using electrodeposition from carbonyls, and spraying techniques. He finds that the electrodeposits are far more satisfactory as they are less brittle, contain less oxide inclusion, and give better coverage around corners than the sprayed coatings.

Dr. N.S. Corney has been examining the reaction of graphite with CO_2 for the Atomic Energy Establishment. Tracer techniques have been used to examine

the amount of oxygen exchanged between the gas and the surface of a fine powder. At the moment, there seem to be some indications that impurities in the graphite are a major factor.

Dr. C.D.A. Elvin has made some interesting findings on W-Re alloys, with the field emission microscope. On evaporating layers, certain groups of atoms seem to require a higher field than the rest of the layer and stay behind on the tip. The number of atoms in these groups increases with Re content, suggesting that these groups are locally ordered regions, or clusters. However, he has not yet been able to find anything specific about the nature of the neighbors of these Re atoms.

Dr. T.B. Copestake's group is concerned primarily with the growth of garnet and ruby crystals and the sintering of ceramic powders. The flame fusion process is generally employed for crystal growing, but there is some experimental work going on pulling crystals from a melt, and precipitating from supersaturated (lead) salt solutions. The last process has produced large crystals, but they are not very perfect and often contain large glassy inclusions.

In trying to obtain highly dense ceramics, Copestake's group is concerned with the reasons behind discontinuous grain growth. (The grain boundaries move so quickly that they leave pores behind rather than absorbing them.) The facets on such grains have suggested to others that there may be a thin liquid layer at the boundaries, but so far they have not been able to detect it. Inclusions may hold up the grains, as in steel, but when discontinuous growth starts, the impurity concentration may build up to produce a liquid layer and hence the facets. Interest is also high on the application of the latest theories of sintering, especially as they apply to the later stages in which grain growth is occurring; the theories to date do not include this.

They are much aware of Dr.D.Lewis' work at Battersea College (ESN 20-8), who has detected very high lattice strains -- what we have normally thought to be brittle ceramics. The stored energy per particle is comparable to the surface energy. Some of his X-ray studies have been duplicated in the X-ray group at GEC, and now this group is interested in determining whether the strain is in the bulk or just in the surface layers. If the latter is true, it would explain the observation of increased interdiffusion with decreasing particle size. They are planning to examine this by X-ray line broadening, using long and short wavelengths to vary the depth of penetration of the beam. Experiments will start soon on the effect of this stored energy on sintering. (Lewis had found that with Al_2O_3, sintering took place at temperatures about 200°C lower than on sintering without prior grinding.) There is also some interest in colloidal ceramics.

The interaction with the diffractions group is largely the result of the general interest of Mr. H.P.Rooksby. There is a long tradition of diffraction and crystallography in the UK, and they still seem to be blossoming here. Since he joined GEC in 1924, Rooksby has been one of the pioneers in their industrial applications. His "chemical services" group provides routine powder diffraction, fluorescent and spectroscopic analysis. In addition, a number of research projects are undertaken for the other laboratories, or independently. He has helped train a number of well-known figures in diffraction in this country, such as B.T.M. Willis.

For a number of years E.H. Kellett and Rooksby have been studying graphitization using X-ray line positions, breadths, and intensities under contract to AERE. Their work has been published in the literature, so I will only briefly summarize their findings. Surprisingly, the expansion along the c-axis <u>is independent</u> of the state of graphitization (even though the basal plane spacing varies with perfection) except at perhaps near 4.2°K. Measurements in this vicinity are just beginning to be made with a new cryostat. The minimum in the coefficient of expansion in the "a" direction has been confirmed and more accurately measured. The rms amplitude of vibration along the c-axis increases with temperature (more slowly for more imperfect graphite) and the "free space" - the spacing of based planes minus twice the rms vibrational amplitude - <u>decreases</u> with increasing temperature. Because of the weak interplanar bonding, this fact helps to explain the increase in strength and elastic modulii with increasing temperature

Bromination reduces the crystallinity, but no compounds could be detected: Slight heating eliminates the

bromine, and the structure can be returned to its original state. Unfortunately, the effect of bromine saturates; therefore, it probably cannot be used to simulate the effects of radiation in a reactor, except qualitatively.

C.A. Wallace and B.J. Isherwood have developed a particular competence in X-ray diffraction topography. A new Lang camera with many additional motions (such as for film placement and translation) is being built. Some interesting applications of the technique have been made. For example, in one topograph, the location of each of the several polymorphs of SiC in a polycrystalline deposit was obtained from the images of a reflection from each polymorph. Using the spacing between two doubly-diffracted beams involving the 133 or 313, and the 222 reflections, they have determined the lattice parameter of Si with a precision of $\pm$ 3 x 10^{-5} Å. (The value differs from that of other investigations by 1 x 10^{-4} Å.) (J.B. Cohen)

MECHANICS

Some Activities of the Cement and Concrete Association

The Cement and Concrete Association in Great Britain is a non-profit body, financed by a number of cement manufacturers through a levy. It offers to users of cement and concrete a free service of technical information and impartial advice. Further activities are research, technical education, the promotion of better and more economical concreting practice, the study of new uses of concrete, and the publication of both popular and scientific booklets and reports. The Association does not engage in the manufacture or sale of cement.

Two aspects of work promoted by the Association are represented by the Concrete Structures and Technology Group of the Civil Engineering Department of Imperial College, London, and the Research and Development Division of the Research Station at Slough, Bucks.

In about 1946, the Association established the Chair of Concrete Structures and Technology which is presently held by Professor A.L.L.Baker. A one-year program leading to a Diploma of Imperial College (D.I.C.) was established to train prospective engineers. As the D.I.C. is not awarded by the University of London, the entrance standards are set by the College. As a result, it is possible for one with more professional than academic qualifications to be admitted. About 35 students per year enter.

The first term of the program includes basic courses in analyses, plates and shells, intermediate structures and concrete technology. In the beginning of the second term, the students elect a major and a miror course which are continued the third term. Using the major course as a basis, the student is expected to write a dissertation which is either a review paper or a completely worked-out problem. Some examples of dissertations presented in May 1966 are (1) Earthquake effects in structures, P.J.Taylor; (2) Membrane stresses in hyperboloidal shells of revolution for cooling towers, T.J. Tipler; and (3) Methods of arrangement and tabulation to facilitate computation of the solution of linear equations for shallow cylindrical shells, S.C. Chong. An important aspect of the program is the Design Project. This is started at the beginning of the Second term, and a prize is awarded for the best design at the end of the year.

Though not properly considered an activity of the Association, one might mention the research activity underway by members of the College staff and graduate students in Baker's group. One of the staff, Dr. J. Munro, is active in the field of reinforced concrete shells. Some of his past work has been reported at the World Conference on Shell Structures in San Francisco in 1962 ("Some Tests on Thin Shells of Reinforced Mortar") and at the Symposium on Shell Research in Delft in 1961 ("An Investigation of the Strain Distribution in Reinforced Concrete Shallow Thin Shells of Negative Gaussian Curvature"). One of his present students, K.C. Michael, is currently investigating the properties of various assumed forms for the deflection in a Rayleigh-Ritz formulation of the solution for the bending of a shallow, hyperbolic paraboloidal shell with a rectilinear planform. Some assumed forms can be chosen which satisfy certain realistic boundary conditions for the deflection but which lead to rather unrealistic behavior of the transverse shear stress. Michael is attempting to find a set of functions which will yield realistic boundary values for both deflections and stresses.

Some recent theses have included

a very large amount of computational work performed on the "Altas" at the Institute of Computer Sciences which is located near University College. For example, P.J. Moss considered the non-linear behavior of a circular cylindrical shell under axial load in "The Stability of Thin Shells" (1965); and S.Z. Uzsoy worked up a finite difference scheme for linear, elastic shells in "Certain Aspects of the Stress Analysis of Shells of Revolution" (1966). This latter thesis includes an analysis of the Ferrybridge Cooling Tower as an example. Such computer work is likely to increase as IBM made a gift of a Model 7090 to the College two years ago; this has since been augumented by the installation of a Ferranti High Speed Data Link with the "Altas."

In Baker's Structures Laboratory there are several tests in progress. The effect of oscillating transverse forces on reinforced beams is being observed; and rectangular slabs in biaxial stress are being loaded to test various failure theories. There is a prestressed concrete nuclear pressure vessel that was heated and loaded to failure. Some of the experimental work is industry funded.

The Research Station is set on a country estate in a strictly rural atmosphere a few miles from the center of Slough. The original house is still in use, but has been augmented by the addition of a number of attractive two-story concrete buildings. The original gardens are still maintained, and are available for the recreation of the staff. There is also a demonstration area where precast panels are displayed as well as prize-winning park benches and trash bins.

In addition to the printing facility for the many publications and technical reports of the Association, the principal activities at Slough can be considered to be either in education or research and development.

At present, about 40 students are housed on the estate at any given time, taking a variety of courses of a week's duration. These courses range from those designed for manual laborers to those for architects. A nearby estate has recently been acquired. With this additional space, it is expected that the number of students that can be housed will be increased. It will also allow several courses to be conducted concurrently, and it is planned to extend the duration of some up to a month.

The research and development activities can be broadly divided into Chemistry and Physics, Materials and Structures. The activities and scope of the Station are directed by a board which includes a number of university professors; hence, work is not duplicated and information can be shared.

The activities of the Structures Department are largely in testing and development, and a great deal of work is done for consulting firms at below-cost prices. However, on the analytical side, Dr. W.B. Cranston is developing computer methods for the analysis of elastic-plastic plates, shells and frames.

There is a variety of projects in progress in the Testing Laboratory. The feasibility of using a single dowel pin to join a reinforced column to a beam is being studied (Fig. 1). The T-shaped structure is loaded vertically in a testing machine while transverse loads are applied.

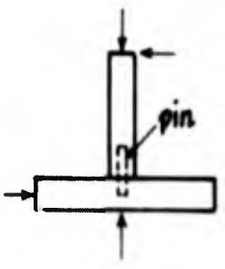


FIG.1

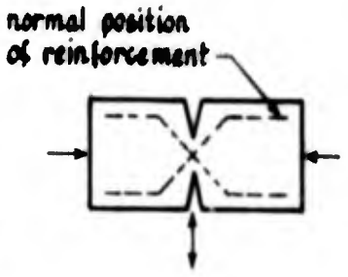


FIG.2

The design of a hinge without reinforcement is being developed (Fig. 2). The actual hinge is tested in compression while an oscillating transverse load is applied. It is found that the complex stress distribution in the contact region of the hinge is such that the concrete develops appreciably more strength than heretofore expected.

A very elaborate model of a flyover (overpass) was in the final phases of being tested. Dead load was simulated by hanging weights through "Christmas Trees" that were tied to the bridge deck. Lines of vehicles and an exceptional vehicle could be simulated. The entire assembly was also loaded by load cells to simulate the action of an adjacent section of the flyover. All readings of strain gauges were measured and recorded on digital voltmeters so that a large amount of data could be conveniently

taken.

A very impressive experiment is the model of a cooling tower which stands about 20 ft high. It is a true hyperboloid as compared to the Ferrybridge tower which was largely conical. The shell wall is made in segments of a few inches in height (several segments needed to complete a level) and mortared together. A ring is attached at the top, and the wall near the bottom is thickened. The aggregate in the concrete is very small in order to conform to the geometric modeling of the actual tower.

It was originally thought that the mode of failure in buckling due to the wind-load would be largely confined to the upper region, and hence no provision for dead loading was included. However, an observer at the scene at Ferrybridge took a photograph which shows large deflections in the lower region. Hence, as an afterthought in order to simulate this load effect, cables which could be tightened were attached at about 80 positions between the shell wall and the base.

The actual wind-load profile is shown in Fig. 3, and the load will be applied by cables tied through pads to the tower wall and a vertical post attached to the floor. The resultant pressure on the lee side of the tower is zero, as a significant contribution to the pressure is made by the internal flow. The electronic digital voltmeters will be moved from the site of the flyover in order to facilitate the taking of data when testing gets under way.

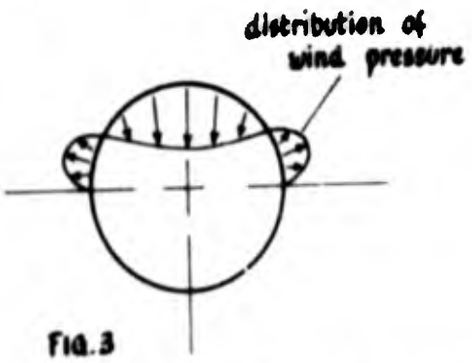


FIG.3

Other examples of work in progress were (1) a study of shear failure in transversely loaded beams, (2) a correlation with Yield-Line theory for a transversely loaded plate and, (3) the progression and development of cracks in a beam with transverse reinforcement loaded by a constant moment. (H.E. Williams)

MISCELLANEOUS

The Shifting Educational Scene

For a period, new universities seemed to appear almost weekly in Britain. Battersea, Brunel and Cranfield have achieved such status this summer. There is considerable discussion of the possibility of starting junior college systems. And the Universities of Manchester, Leeds, Liverpool, Sheffield and Birmingham have joined together in setting up more common entrance requirements. While the vast majority of Englishmen still leave school before age 16, it is clear that this will not be the case in five or ten years.

The University of Manchester has started an honours course in "Liberal Studies of Science," aimed at giving students a broad picture of science, its application, structure, management, and its interaction with society. Students from the Sixth Form in humanities will soon be accepted, as will those with backgrounds in science. The object is to provide a program suitable for those interested in industrial management and government, rather than science and engineering *per se*. (The University of London has been experimenting with such a course for a few years.) (J.B. Cohen)

BBC on Oceanography

The British Broadcasting Company is now editing film for a series of seven programs on oceanography to be broadcast on television BBC-2 on Friday evenings at 7:30. Present schedule calls for the first program in the series on 18 November 1966.

Although no details about this series are available, it is known that three days of filming and recording were carried out in the US at Woods Hole and Scripps. It is also known that Dr. John Swallow of NIO will be interviewed in one of the programs.

Visitors to the UK during the period November-December may be interested in viewing what promises to be an interesting and informative series. (J.E. Bennett)

Mini Mini TV for Britain

Clive Sinclair, British electronics engineer and President of Sinclair Radionics, Cambridge, demonstrated 405 line microvision TV (coat pocket size: 4"X2.5"X2", 10.5 ounces) at the Television and Radio show. The key factor

in the "mini" TV is a new type of simple 30-transistor circuit which can be produced at low cost. The firm maintains that "microvision will do for TV what the transistor did for radio." That is, move it from the corner in the living room into everyone's pocket. It also is claimed that the set makes possible the much discussed "look and talk" telephone system. Production plans of 1000/month starting in January were disclosed. Initial price will be £50. (P.D. Maycock)

PHYSICAL SCIENCES

Far Infrared Spectroscopy at Freiburg

Prof. L. Genzel has long been known for his contributions to far infrared spectroscopy. He left the Physical Institute of the University of Frankfurt in 1960 to become the professor in charge of the infrared program at the Physical Institute in the University at Freiburg, Germany. According to Genzel, the Freiburg Institute was the first in Germany for which all areas of physics are under one institute. There are approximately 10 professors of physics at Freiburg and the principal assistants (comparable to associate professors) of Genzel are Drs.H.Happ, K.F.Renk and R.Weber.

There are 20-25 research students active in far infrared spectroscopy. The programs are directed toward obtaining a better understanding of the physics of solids; one of Genzel's principal goals seems to be that of obtaining a material from which a bulk detector and/or bulk harmonic generator can be developed. The far infrared laboratory is well equipped and includes about 10 grating spectrometers, several Fabry-Perot interferometers (FP), at least one interference spectrometer, and a Collins liquid helium generator.

Although most of the experiments are performed with the classical mercury arc generator (incoherent), Happ is now completing the development work for a system that employs a coherent source and a crystal-diode frequency multiplier. The equipment is being developed for studying solids at wavelengths of $\frac{1}{3}$ mm and shorter. Although Happ is aware of the merits of detection with crystal diodes (von H. Happ, W. Eckhardt, L. Genzel, G. Sperling and R. Weber, Z. Naturforsch., 12a, No. 6, 1957), he uses a Golay cell detector, thereby eliminating one set of critical diode adjustments necessary to obtain a signal initially. An FP, operated with 20:1 resolution, is used as a harmonic selector. In this arrangement a high resolution is not needed because the interferometer is required only to pass the desired harmonic and to reject the unwanted ones.

Originally Happ used an 8-mm klystron to drive a conventional cross-guide frequency multiplier-detector, but he is now using a 2-mm CSF carcinotron for which the frequency can be easily changed. Available output power is 1 W but only 100 mW is used, because more than this will burn out the whisker of the harmonic generator. Oversized (4-mm) waveguide is used to minimize attenuation, and samples will be placed between two dielectric lenses. Most of Happ's recent effort has been consumed in developing his new system, and it appears that it will soon be completely debugged.

The low burn-out levels of about a 100 mW for the whisker in a diode harmonic generator limits over-all system sensitivity. On the other hand, a driving power of several tens of watts can be used with a Froome-type plasma harmonic generator (K.D. Froome, Quantum Electronics III, Columbia University Press, edited by P. Grivet and N. Bloemberger, 1964), but a plasma generator is to some extent plagued by fluctuations in output power. In principle, generator stability can be improved by increasing gas pressure. Genzel feels that an output sufficiently stable for general spectroscopic use would result only for pressures so great that attenuation due to window thickness would be too excessive for practical use.

In an effort to obtain a source of millimeter-wave power, Genzel recently generated Cerenkov radiation by accelerating electrons with a 200-kV potential. To obtain an interaction that satisfies the conditions for producing the radiation, an electron beam of several milliamperes was directed along a small-diameter crystalline rod. According to Genzel, the device will not provide a useful amount of output power unless electron bunching is somehow accomplished. The program has now been abandoned, except for the completion of a paper, because Genzel feels that the bunching instrumentation required would be too large and expensive for the generator to be of practical importance.

The only current laboratory research on generators, per se, is directed toward an effort to find a

material from which a bulk (semiconductor) harmonic generator can be developed. However, Genzel has initiated an effort on the application of lasers to spectroscopy. Equipment is now being assembled and built for research on the application of a 300-μ laser (H.A. Gebbie, N.W.B. Stone, and F.D. Finlay, Nature, 202, No. 4933, 685, May 16, 1964). An FP will be used in an effort to reject the numerous extraneous lines which characterize the output of such a laser. Genzel expressed concern over the small amount of power available, and he is searching for a method of increasing the output level.

The FP offers the advantage of possibly having the highest transmission efficiency for a given resolution of any far infrared instrument. Genzel's group has constructed several FP's for wavelengths between 100-600 μ that have Q-values of 5-30, and peak transmissions up to 90% have been obtained (R. Ulrich, K.F. Renk, and L. Genzel, IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-11 p. 363, September 1963). Metal meshes are used as reflectors. The mesh is made for sorting particles, and is manufactured by Buckbee Mears Company, 245 East 6th Street, St. Paul, Minn. As previously mentioned, Happ uses an FP as a separator of harmonics, but a tunable FP can serve as a useful general-purpose band-pass filter. Application of the FP as a dispersion element has also been considered (R.Ulrich, K.F. Renk, and L. Genzel, IEEE Transactions on Microwave Theory and Techniques, Vol. MTT-11, p. 363, Sept 1963).

Because some of the new low-temperature detectors have a fast response, there is need for a good high-speed chopper for the far infrared. A thin plate of germanium to which is applied a static magnetic field and the modulating voltage has been used for a chopper. The percentage modulation decreases with increased modulation frequency, but modulations in excess of 50% have been obtained for frequencies up to 100 kc. Transmission and reflection measurements have been made on metallic meshes in an effort to find an efficient and broadband partially-reflecting plate for a Michelson interferometer. Measurements have been made for normal and 45° incidence, and Genzel finds that the losses of the meshes studied are not larger than 1%. The transmission properties are a complicated function of polarization. Measurement results for the chopper and the meshes have been published (L. Genzel, Japan. J. Appl. Phys. 4, Supplement I, 353-357, 1965).

Genzel has been a major contributor (L.Genzel and R.Weber, Z.Angew. Phys. 10(4), p. 195, 1958, Translation: DDC AD 252 310) to the concepts of Fourier-type interference spectrometers. These highly successful instruments cannot be used in his studies of non-linear phenomena in solids, however, because a Fourier instrument simply marks spectral elements by means of different modulation frequencies without selecting them out of the beam. Therefore, for non-linear phenomena one might use a grating monochromator (L. Genzel, H. Happ and R. Weber, Z. Physik 154, 1-12, 1959), an FP instrument or a prism. Genzel feels that a prism spectrometer may now be possible below 250 cm^{-1} by using crystalline prism materials normally used in the near and medium infrared. This seems possible because it is now known that at low temperatures (4°-80°K) the prism materials become transparent in the far infrared without losing their dispersion (H.Bilz and L. Genzel, Z. Physik 169, 53, 1962; H. Hadni, Spectrochim. Acta. 19, 793, 1963). A remarkable exception is fused silica which does not change its absorption between 4° and 300°K and which is therefore an excellent window material for low temperatures. (M.W. Long)

Sector-Shaped Antenna Patterns

At the German Post Office and at Siemens and Halske AG, much effort is being directed toward developing so-called sector-shaped patterns, the objective being to minimize sidelobes while retaining efficient aperture illumination. The ideal sector-shaped pattern is constant over the beam and has no sidelobes. Patterns actually considered are "cone-shaped" because the apertures being used have circular symmetry.

The German Post Office seems to be a combination of the Post Office Department as we know it in the States, the Federal Communications Commission, and the American Telephone and Telegraph Company. Dr. G.F. Koch is Head of the Antenna Group of the Bureau of Telecommunications, German Federal Post Office, Darmstadt, Germany. A wide variety of microwave antenna research and development tasks are pursued under Koch's direction,

including antennas for relay links and for satellite communications systems. The group was involved with preliminary designs for the German earth satellite at Raisting, but detailed design and construction was handled at the Central Laboratory of Siemens and Halske in Munich. Antennas for relay links and for satellites are also investigated at the Central Laboratory.

At microwave stations a conventional parabolic-reflector antenna of relatively large focal length (shallow reflector) often cannot be employed because its sidelobe attenuation is too poor. Horn-reflector antennas can sometimes be used, but they are bulky and expensive. However, a high-gain factor with high-sidelobe attenuation (at large angles) can be obtained by illuminating a deep reflector with a primary radiator having a pattern which is approximately sector-shaped.

It is well known that in the case of the two dimensional problem, a sector-shaped pattern is produced by a sin x/x aperture distribution which requires an infinite aperture and an infinite number of oscillations in the amplitude distribution. Koch has investigated the case of an axially symmetric aperture to produce a "cone-shaped" pattern, and as expected, found that the required illumination function is also oscillatory and requires an infinitely large aperture. However, the desired patterns can be approximated with a finite aperture and a number of oscillations in the distribution function. The calculated far-zone patterns are nearly constant in amplitude across the main lobe, but the finite aperture width causes some waviness in that lobe and the appearance of sidelobes.

Koch has studied analytically the detailed requirements for obtaining a sector-shaped pattern from a finite aperture, and he has developed some feeds for the task (G.F. Koch, NTZ 18 No. 6, 324-330, 1965; NTZ 18, No. 7, 374-379, 1965); the papers have been translated into English for publication soon in NTZ-Communications Journal. One of the feeds consists of a central waveguide and five conductors with circular cross sections arranged coaxially. In this way an aperture is obtained which consists of a central circular zone and five ring-shaped sections. In order to permit adjusting the amplitude and phase of the individual sections of the feed, the various outputs are connected to a power divider via phase shifters and attenuators.

Feed diameter is 24 cm, and the feed is so dimensioned that at 10 Gc the pattern closely approximates the desired sector shape. The calculated main-lobe width between 20-dB points is 120°, and the calculated sidelobes are smaller than 20 dB below the main lobe. Measured patterns show reasonably good agreement with the calculated main lobe, but the near-in sidelobes are only 17 dB below the main lobe. It was planned that the TE_{11} mode would be used in the various parts of the composite feed, but it has been difficult to suppress the TEM and higher order modes in the coaxial sections. A mode filter, consisting of radially arranged strips, has been used to short circuit the radial (TEM) field components. This arrangement has provided a 10-dB reduction in antenna spillover, as compared with a conventional horn feed that gives equal antenna gain (G.F. Koch, Institution of Electrical Engineers Conference Publication No. 21, London, 6-8 June 1966).

Additional improvements in the wide-angle radiation patterns will result from further reduction in the feed side-lobes which are caused by cross-polarized components from the feed. Koch believes that he can suppress these cross-polarized components, and he is therefore now trying to reduce overall feed size in order to minimize aperture blocking.

Peter Thust of Siemens and Halske has developed a horn feed, based on sector-shaping techniques, that has been successfully used to illuminate a parabolic reflector (P. Thust, Proc. IEEE, 53, 1239-1240, Sept 1965; Frequenz, 20, No. 5, 148-155, 1966). TE_{11}-modes are propagated in the waveguide which is circular, and the feed can be used for two perpendicular polarizations over a broad frequency band. The feed has a large flange in the aperture plane, and on the flange there are mushroom-shaped elements. Antenna gain with a 3-m diameter reflector is 43 dB over the frequency range of 5.9-6.4 Gc. With edge shields, sidelobe level is more than 60 dB below the main beam for angles greater than 76°.

Mr. W. Rebhan of Siemens and Halske has been investigating modified sector-shaped patterns for use with attitude-controlled satellite-borne antennas. For an ordinary pencil-

beam antenna, a considerable part of the radiated energy is wasted by bypassing the earth; on the other hand, if a highly directive beam is used, only the central area of the earth's surface is well illuminated. To effect constant illumination over the earth's surface, a cone-shaped radiation pattern with a spherical depression is needed to compensate for the higher path-losses in the directions far removed from the beam center. Rebhan has recently published (W. Rebhan, Frequenz, 20, No. 5, 156-165, 1966) a theoretical analysis and some experimental data on the illumination of a circular aperture for producing a uniform signal over the earth. (M.W. Long)

NATO Advanced Study Institute on the Optical Properties of Solids

NATO supports research in essentially three different ways. Similar to the system of research contracts in the US, research grants are given to institutions for certain projects; fellowships, particularly at the postdoctoral stage, are granted to scientists in the NATO countries; and last, but not least, advanced study institutes are sponsored on topics of current interest.

Since the optical properties of solids are presently in the focal point of research, NATO together with ONR and ARPA sponsored such an Advanced Study Institute in Freiburg, Germany, 7-20 August 1966, on this subject. The Institute can best be compared with a summer school. A staff of lecturers present a review of their specialty to an audience of mostly the post-graduate level. Panel discussions unite audience and staff in an evaluation of the present status and the future development of the field in general. Out of these discussions, it is expected that the participants will gain some feeling of research accomplished, in progress, and directions to go in pursuit of new research activities within their own countries.

Twenty-four lecturers presented the different aspects of solid-state optics to one hundred registered participants. Neither staff nor audience was restricted to countries of the NATO community. The excellent and indispensable lectures on the spectra of amorphous materials by J. Tauc, from NATO-opposed Czechoslovakia, and on excitons by S. Nikitine of France proved the internationality of this effort beyond the boundaries of NATO.

Lattice dynamics and optical features induced by impurity and defect states were well represented at the Institute through lectures by H. Bilz (Frankfurt), L. Genzel (Freiburg), C.W. McCombie (Univ. of Reading), S.S. Mitra (U. of Rhode Island), and R.H. Silsbee (Cornell Univ.). S. Marshall (Argonne National Lab.) lectured on the EPR of ions in crystals. D.L. Wood (Bell Labs) and D.S. McClure (U. of Chicago) presented the electronic spectra of ions and molecules, respectively. Excitons were the subjects of lectures by S. Nikitine (Strasbourg) and D.Reynolds (Wright-Patterson AFB). F. Matossi (Freiburg) and J.J. Markham (U. of Chicago) talked on luminescence and the configurational model. The pressure dependence of optical spectra and magneto-optics were dealt with in lectures by D. Langer (Wright-Patterson AFB) and S.D.Smith (U. of Reading).

The close and indispensable relation between the band structure of a solid and its optical properties was the central theme of a number of lectures. L. Pincherle (Kings College, London) presented the fundamentals of the band model and H. Jones (Imperial College of Science & Technology, London) developed the related group theory. M. Cardona (Brown University) went in detail into the intricacies of dispersion relations. B.O.Seraphin (Michelson Laboratory) reported on the more recent differential reflectance techniques, in particular electroreflectance. R. Potter (NOL Corona) and J. Dixon (NOL White Oak) gave excellent surveys of the fundamental experimental techniques in optical studies.

The organizers of this Advanced Study Institute, S. Nudelman and S.S. Mitra (both of the U. of Rhode Island) and F. Matossi (Freiburg) deserve credit for a smooth and efficient organization. They managed to extract manuscripts from the lecturers in time to distribute the lectures ahead of time, and they taperecorded the lively and informal panel discussions. Both will be published as Proceedings of the NATO Advanced Study Institute by Plenum Press before the end of the year. In addition, a detailed report will shortly be available from this office. (B.O. Seraphin)

PSYCHOLOGICAL SCIENCES

It Isn't What You Have -- It's What You Want That Counts

The Danish concept of "trivsel" is related to satisfaction, but it has not a precise English equivalent. Broadly speaking, trivsel implies, in addition to satisfaction, a certain general state of individual self-fulfillment, congruence of expected and achieved goals, etc. Eggert Peterson, Director of the Danish Mental Health Association in Copenhagen, has been interested in the concept for some years, and currently is completing an extensive study of trivsel in Danish industry. Data analysis has not yet been completed, and Petersen is not ready to commit himself with regard to his findings or their significance. There are, however, certain trends emerging from the data which give rise to rather intriguing speculations about the ideal society. Because of the interest on the contemporary American scene in philosophical issues related to utopian societies, it is considered both timely and appropriate to engage in a bit of speculation on the basis of imcomplete data.

Within the past seven years Denmark reportedly has experienced a 40% rise in national income over the cost of living. There is no significant unemployment, university education is free to all, medical care is provided from the cradle to the grave, and there are old-age benefits for all. At the same time there is reported to be a belief in some circles that the Danes are more generally dissatisfied with their present life situation than they were seven years ago. The possibility that progress toward a utopian society was hindering individuals in their search for trivsel led Petersen to embark on a rather extensive series of studies.

Subjects for the present study were obtained from 15 factories which were considered to constitute a representative sampling of Danish industry. A 59-item satisfaction scale provided the primary data for the study. This scale, based on a mathematical model developed by George Rasch, Professor of Statistics at Copenhagen University, provides for analysis of trivsel in terms of two parameters. One parameter characterizes the individual and the second characterizes the factory. (An extensive discussion of this model may be found in a recent paper by Rasch -- An Item Analysis Which Takes Individual Differences Into Account, Brit. J. Math. and Stat. Psych., 19, 49-57, 1966.) Considerable biographical information was available on the subjects, and information also was available on a number of variables characterizing the factories. Petersen's theoretical position is basically quite straightforward: satisfaction or trivsel is considered to be a function both of an individual's expectations and the degree to which these expectations are fulfilled by his milieu -- in this case the factory.

His results to date indicate that satisfaction appears to be inversely related to expectation. That is, the lower one's expectations, the more likely they are to be fulfilled and the higher the degree of satisfaction. Generally speaking, individuals with a history of broken homes, low social-economic status, etc., in fact, characteristics directly opposite to those usually associated with healthy adjustment, demonstrated a higher degree of satisfaction. Again, the expectations of individuals with disturbed or impoverished backgrounds did not appear to reach the same magnitude levels as their more fortunate colleagues.

A number of variables pertaining to characteristics of factories were found to be significantly related to satisfaction. For example, group size was inversely related to satisfaction, and area of working space was found to be directly related. Greater satisfaction was found in those factories where foremen were imported from other departments rather than being promoted from within the department which they supervise. Moreover, trivsel was found to hold a direct and positive relationship to the percentage of the people in the work group who held leadership roles. Thus, trivsel appeared lower in those factories where the nature of the work was sufficiently routine or uncomplicated as not to require a multiple leadership hierarchy.

As indicated at the beginning of this article, Petersen is not yet ready to claim that the increase of well-being among the Danish people has led to a commensurate decrease in trivsel or satisfaction. In fact, his present research really isn't designed to provide a direct test of such a hypothesis. On the other hand, he is beginning to think in terms of

a formulation whereby expectation accelerates at a greater rate than the standard of living in the prosperous or utopian society. This increases the discrepancy between expectation and realization of expectation which in turn leads to a consequent decrease in trivsel. (J.E. Rasmussen)

Notes on Danish Military Psychology Service

The Danish Armed Forces Psychological Service (Militaerpsykologisk Tjeneste or MPT) was described in some detail about 18 months ago in Technical Report ONRL-18-65. Since that time the organization has continued to grow, and it recently has been assigned a responsibility that will make this group one of the more significant military psychology organizations in Europe.

The structure of MPT has not changed markedly from that described in the 1965 report. The staff has been increased by two military psychologists, and it is hoped to add four more fully-trained civilian psychologists and an unspecified number of supporting personnel in the near future. When this comes about, there will be some reorganization, mostly to accommodate the programs upon which MPT will embark in the immediate future.

The pronounced lack of interest in selection which has been present for some time at MPT remains unchanged. This is not surprising, as there is compulsory military service for all male Danes, and the primary need for selection programs comes in the appointment of officer candidates and aviation cadets. Likewise, classification is not a major problem, as relatively few men from the total available population go to specialized service schools. These individuals are picked from the small but relatively easy-to-identify group of superior conscripts. The previously reported trend towards an increasing emphasis in training has continued. However, this coming fall will see an expansion of research both in the areas of small group interaction and in training.

While the Danish MPT has been engaged for some years in giving lectures or courses to various categories of personnel, this function is assuming such magnitude that a special section is being established to handle the teaching program. The Danes probably emphasize the role of teaching as much, if not more, than any other military psychology program in Europe. As might be expected, lectures are given to cadets and midshipmen at the service academies, and for some time a three-month course has been offered for junior officers who are scheduled to serve as instructors in military schools. This year a program has been established whereby all Danish Army officers at the Major level will receive two weeks of sensitivity training. It is interesting to note that the more rigid and tradition-bound Danish Navy is not participating in the program; however, those sensitivity training courses held to date have been both very well received and judged to be quite successful.

Probably the most significant recent development in Danish military psychology is the decision to establish a 1½-year program in the principles of military psychology and education at the level of the Command and General Staff Course. At present, senior officers being groomed for major command positions and/or promotion to general officer rank have two options for specialized training in this course: a two-to three-year tactical course or a 1½-year technical curriculum. The third option, which will be under the direction of the MPT is intended to prepare officers for command of service schools and senior billets concerned with military manpower utilization.

The history of this development is quite intriguing, and it probably would not have occurred exactly in this manner in any country other than Denmark. At this point, it might be added that the factual statements, as far as can be determined, are correct; the interpretation of the events and cultural influences leading up to establishment of this course is that of the present writer and should be accepted as such.

The Danish people are far more concerned with butter and eggs, drinking beer, education, housing, medical advances, and "trivsel" (satisfaction, fulfillment of personal life goals and enjoyment of living) than they are with national defense and the military. It might be safe to say that the Danish people as a whole are mildly anti-

military. The German occupation of World War II is vividly and unpleasantly remembered. Moreover, one occasionally receives the impression that Danish history plays some part in the genius of present-day attitudes. If one or two of the better-known Danish kings of the 17th and 18th centuries had spent more time at home in the pursuit of trivsel and drinking beer instead of attempting to conquer his neighbors, Denmark well might be a much larger and influential country today.

Coupled with a less than enthusiastic attitude toward the military is a deeply ingrained pride in and defense of intellectual and personal freedom. A democratic expression of individual opinion on any issue about which one might become exercised is a highly prized "right" or prerogative of all Scandinavians -- and there are few countries in the Western World where the citizens make greater use of this right than do the Danes. While it is recognized that the Scandinavians do not have a monopoly in this regard, the mass communication media does have a tremendous influence in conveying their current attitudes, especially of the Danish population. Moreover, the responsiblity for expressing these attitudes is not vested solely in professional commentators and correspondents. The Danish newspapers serve as a forum in which current problems are aired by individual citizens. Letters to the editor and interviews with individuals on controversial subjects in the daily papers would appear to be on a par with national and international news in terms of importance. Of more than passing significance here is the fact that both elected and appointed officials in the Danish government are strongly influenced by and responsive to public opinion.

The combination of generally anti-military attitudes among the citizens of Denmark and a government which traditionally is heavily influenced by attitudes of the people it represents might well be enough to make one wonder how any type of organized and effective armed force can be maintained. Continuing with the subjective and sweeping generalizations which have characterized the last two paragraphs, it would appear that the answer to this question lies in the fact that the Danes tend to be "realists." They know that Denmark cannot maintain an armed force which could cope singlehandedly with all possible threats to their sovereignty; however, from bitter experience they are aware of the necessity for maintaining a sound defensive posture and thus are members of NATO. While the military is considered to be of sufficient importance that all physically fit Danish males are conscripted for military duty, the armed forces (particularly the army) also constitute one of the favorite topics of public discussion and newspaper criticism. The attacks tend to be quite broad in scope, ranging from strategy and tactics of military defense to manpower utilization.

It would appear that the new option at the Command and General Staff Course level has evolved from a period of intense political and newspaper criticism of the armed forces which occurred about two years ago. At that time, there was concern that the services were too military and too "Prussian" in their attitude toward and handling of the young men entering the forces through conscription. In some respects this wave of public sentiment for increased military "democracy" is analogous to that which occurred in the US following World War II.

In February 1965 the Minister of Defense established a "Military Climate Committee" to study ways in which more "psychologically sound" attitudes could be introduced into the armed forces. The Committee was chaired by the Director of the Danish Office of University and Technical College Education, and consisted of 40 members, half of whom were military and half civilian. LCOL Finn Agersted, Director of the Military Psychology Service, acted as secretary. The group took a rather broad approach to their task, and started by collecting and categorizing specific examples of problems which might have any conceivable bearing on the issues at hand. Next, an effort was made to conceptualize the fundamental difficulties or causal factors which characterized the various categories. On the basis of this exercise, it was concluded that difficulties associated with interpersonal communication and other dimensional small group interaction constituted the most important single factor underlying the problems to which the Committee had been exposed. In a report summarizing their findings

three courses of action were recommended to the Minister of Defense: (1) the military psychology research program should be expanded, (2) military officers should be given advanced education in the areas of personnel management, leadership, and education; and (3) a program should be introduced which would enhance military management effectiveness, intra-service cooperation, and communication through a systematic reshaping or changing of officers' attitudes. Because of this latter recommendation, the programs outlined by the Committee have occasionally been referred to under the rather misleading heading of "military democracy." In fact, nothing in the Committee's report or recommendations would lead to changes either in military structure or delegation of authority. The emphasis is solely on changing the broad management approach to carrying out presently existing tasks or functions within the armed forces.

The 40-man Military Climate Committee has completed its task and will be dissolved this month. At the same time a seven-man executive has been formed to serve as a continuing advisory group to the Minister of Defense for implementing the major Committee recommendations. In addition to the Director of the Military Psychology Service, the Executive Committee will be composed of one representative from each service, two civilian educators, and a representative of the Welfare Ministry.

Concrete and meaningful steps already have been taken to carry out the major recommendations of the Military Climate Committee. The six new professional staff members of the MPT will constitute an increase of approximately one-third in the size of the organization and should materially enhance its research capacity. The sensitivity training, commented upon earlier, is aimed at carrying out the recommendation concerned with attitude change. The establishment of the new 1½-year program at the level of the Command and General Staff Course will be the means of carrying out the recommendations for advanced education in personnel management.

It will be at least one year, if not a year and a half, before any officers actually are assigned to the new course, and the full curriculum has yet to be determined. At present it is planned that the first six months will be spent at Copenhagen University attending formal courses which will be developed and taught by members of the Psychological Institute. The next year will be spent at the MPT, where academic work will be combined with an exposure to research. Thus, during the second six-month period, a formal course will be given in statistics and the officers will work as assistants in an ongoing research program. During the final six months, the students will be expected to carry out an independent research project.

There are few countries anywhere in the world where a military psychology program has been given as great a degree of responsibility and latitude within the armed forces essentially to influence the basic structure of the services. In some respects this situation may provide a test of whether psychological theory and the state of the art in the behavioral sciences are sufficiently advanced to have a significant impact in changing the character of an institution as old, large, and well established as the Danish Army. Unfortunately, social psychology is not particularly strong in Denmark. On the positive side, the MPT is generally well accepted by the military. About half of the professional staff are service-academy graduates who have considerable experience as line officers, as well as formal training in psychology to a level roughly equivalent to the US doctorate. Moreover, Agersted, who is directing the program, has the reputation of being a highly skilled military administrator and an excellent applied psychologist. He also has quite strong support from and is well respected by civilian psychologists and the Danish academic community; in fact, he is president of the Danish Psychological Association. Thus, it should be extremely interesting to follow the developments in Danish military psychology over the next few years. (J.E. Rasmussen)

NEWS AND NOTES

The Council of the Scottish Marine Biological Association has announced the appointment of Mr. Ronald I.Currie, BSc, as Director of the Marine Station, Millport, Isle of Cumbrae, Scotland. Currie has been Head of the Biological Section of the National Institute of Oceanography, Wormley, Surrey, for a number of years and brings to the

Millport Station experience and a background of considerable breadth and depth.

In European circles, Currie has been active in the Intergovernmental Oceanographic Commission, the Scientific Committee on Oceanic Research and, more recently, was appointed Secretary of the Oceanographic Section, International Union of Biological Sciences. He is also well known in the Americas, both from visits to oceanographic centers within the US and from participation in the First International Oceanographic Congress, New York, 1959, and the Symposium on Oceanography of the Western South Atlantic, Rio de Janeiro, 1964. Currie, with an active interest in plankton and organic production in the sea, has been concerned for several years with the coordination of the International Indian Ocean Expedition and participated as Principal Scientist on a number of cruises of the RRS 'Discovery.' His publications have covered a variety of topics, including the environmental features in the ecology of Antarctic seas, the Indian Ocean standard net, and oceanography in Brazil.

Currie assumes the responsibilities of Director of the Millport laboratory at an especially important point in the long development of this major Scottish laboratory. The National Environment Research Council has recently approved, for 1967-68, the first installment of the capital sum required to construct the new mainland laboratory near Oban. The laboratory can thus take the first step towards implementation of the plans for expansion of research on the Scottish West Coast which have been under consideration for a number of years. (J.D. Costlow)

The Challenger Society, organized in 1903 to promote the exchange of ideas in the area of marine biology and oceanography in the United Kingdom, offers a unique opportunity for American scientists visiting the UK to meet informally with British scientists and actually participate in the meetings. There are normally four meetings each year, usually lasting two days and, with the exception of the January meeting, marine laboratories and universities with programs in marine biology and oceanography serve as the host organization. They are attended by established workers in these fields as well as by students and recent graduates. The host institution is open to visitors during the meetings and, in addition to providing for an inspection of the research and teaching facilities, it gives an excellent opportunity to discuss research at a level of detail which is rarely possible in the larger symposia.

At the two most recent meetings of the Society, held at the Department of Oceanography, Univ. of Southampton and the Marine Biological Station, Port Erin, Isle of Man, papers were presented which included the following topics: ecology of rocky shores; populations of Laminaria Hyperborea from various latitudes; identification of marine sediments by echo-sounders; distribution of pelagic polychaetes in the Pacific and Atlantic Oceans; studies of the structure of the floor of the Atlantic Ocean; and recent changes in the Manx scallop fishery.

The next annual meeting is scheduled to be held in London, January 26-27, 1967, in the British Museum of Natural History. The Convener, Mr. R.S.Glover, has indicated that he would especially welcome as speakers American scientists who are visiting or working in the UK at that time. Marine biologists or oceanographers who would be interested in attending and presenting a paper should write: Mr. R.S. Glover, Convener, Oceanographic Laboratory, 78 Craighall Road, Edinburgh 6, Scotland. (J.D. Costlow)

A new space project consortium has been set up by agreement between leading aerospace firms in Western Europe. The firms involved are Engins Matra (France), Hawker-Siddeley (UK), Entwicklungsring Nord (W. Germany), and SAAB (Sweden), and they will submit joint tenders for future satellite or space probe projects within Europe and elsewhere.

The National Computing Centre, now under construction at Manchester, will be equipped with its first machine -- a KDF-9 built by the English Electric Leo Marconi group -- early next year. The Centre's Director, Prof. Gordon Black, stated at a recent press conference that he hoped the Centre would become the focal point of a first computer grid system serving the UK. By 1972 it would be possible to link the installation at Manchester by post office telephone lines with approximately 12 computers in other parts of the country, so that

universities, research organizations, and industrial firms could have immediate access to computer facilities at any time.

University College, London's, Electrical Engineering Dept., under Prof. H.E.M. Barlow, is to carry out a research contract on the use of waveguides with low power loss for the transmission of microwave messages. The work will include the installation and testing of a one-mile length of circular waveguide at the Post Office Engineering Department's new research center at Martlesham, Ipswich, to which the Dollis Hill establishment is scheduled to move in the near future.

The Royal Society is to send a two-man team to Aldabra, a long-isolated coral atoll north of Madagascar where flora and fauna have been allowed to breed unhindered by man. Dr. D.R. Stoddard, Dept. of Geography, Cambridge Univ., will study the vegetation and general composition of the land, and Dr. C.A. Wright, Dept. of Zoology, British Museum of Natural History will study the animal life.

Sir Willis Jackson, Professor of Electrical Engineering at Imperial College, London, has been elected next year's President of the British Association for the Advancement of Science.

J.A. Ratcliffe, formerly Director of the Radio and Space Research Station at Ditton Park, Slough, will be President of the Institution of Electrical Engineers for 1966-1967.

Dr. F.S. Dainton has been appointed Chairman of the Advisory Committee for Scientific and Technical Information, succeeding Sir James Cook.

Dr. C.C. Spicer, at present Chief Statistician (Medical) at the General Register Office for England and Wales, is to be Director of the Medical Research Council's new Computer Unit, to be set up in London early in 1967.

Members of the Computer Board for Universities and Research Councils have been appointed as follows: Prof. B.H.Flowers (Chairman), Prof. Gordon Black, Prof. C.E.H. Bawn, Lord Halsbury, Prof. D.J. Finney and J.K. Steward.

Prof. E.A. Guggenheim, Professor of Physical and Inorganic Chemistry at the Univ. of Reading, retires Sept. 30 to become Professor Emeritus. He will be succeeded as Head of the Dept. of Chemistry by Prof. G.W.A. Fowles. Professor of Inorganic Chemistry at Reading.

Dr. C.H. Mortimer, resigning Director, will join the University of Wisconsin at Milwaukee, to continue his research on the Great Lakes.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York 09510.

ONRL-39-66	Some Electromagnetics in W. Germany by M.W. Long
ONRL-40-66	Medical Education and Research in Spain by C.N. Peiss
ONRL-41-66	Some Programs on Millimeter and Submillimeter Wave Spectroscopy in Europe by M.W. Long

The following conference reports are releasable to European scientists:

ONRL-C-15-66	International Symposium on Reaction Mechanisms of Inorganic Solids by S.Y. Tyree
ONRL-C-16-66	Seminar on Strength of Materials, Cavendish Lab, Cambridge by J.B. Cohen
ONRL-C-17-66	Conference on the Physics of Semiconducting Compounds, Univ. of Swansea, Wales, by B.O. Seraphin

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Office of Naval Research, Branch Office London, England	2a. REPORT SECURITY CLASSIFICATION 2b. GROUP

3. REPORT TITLE

EUROPEAN SCIENTIFIC NOTES 20-9

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

N.A.

5. AUTHOR(s) (Last name, first name, initial)

Rasmussen, J.E. and Hewitson, Victoria, ed.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
	24	27

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
N.A. b. PROJECT NO. c. N.A. d.	ESN-20-9 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) N.A.

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
N.A.	N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473

UNCLASSIFIED

Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
AEROSPACE SCIENCES MATERIALS SCIENCES SOLID MECHANICS PHYSICAL SCIENCES PSYCHOLOGICAL SCIENCES EARTH SCIENCES						

INSTRUCTIONS

1. **ORIGINATING ACTIVITY:** Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. **REPORT SECURITY CLASSIFICATION:** Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. **GROUP:** Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. **REPORT TITLE:** Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. **DESCRIPTIVE NOTES:** If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. **AUTHOR(S):** Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. **REPORT DATE:** Enter the date of the report as day, month, year, or month, year. If more than one date appears on the report, use date of publication.

7a. **TOTAL NUMBER OF PAGES:** The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. **NUMBER OF REFERENCES:** Enter the total number of references cited in the report.

8a. **CONTRACT OR GRANT NUMBER:** If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. **PROJECT NUMBER:** Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. **ORIGINATOR'S REPORT NUMBER(S):** Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. **OTHER REPORT NUMBER(S):** If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. **AVAILABILITY/LIMITATION NOTICES:** Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. **SUPPLEMENTARY NOTES:** Use for additional explanatory notes.

12. **SPONSORING MILITARY ACTIVITY:** Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. **ABSTRACT:** Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U).*

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. **KEY WORDS:** Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

Security Classification

AD NUMBER: AD0803496

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 25 Nov 1966. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH

BRANCH OFFICE — LONDON, ENGLAND

TECHNICAL REPORT
ONRL-47-66

NOTES ON PSYCHOLOGY IN NORTHERN IRELAND

BY

JOHN E. RASMUSSEN

25 November 1966

NOTES ON PSYCHOLOGY IN NORTHERN IRELAND

Queen's University of Belfast is the only university in Northern Ireland. Founded as a constituent college of the Royal University of Ireland in 1845, it was separated from that institution in 1908 and granted full university status. At present the University receives its primary financial support from the Government of Ulster, and it has grown to include six colleges. The student body numbers approximately 5,000 men and women. Degrees are awarded in a wide range of fields, including agriculture, law, medicine, and theology.

The main campus is located about one mile from downtown Belfast; however, the University's growth has been such that various departments and buildings are spread out in quarters as far as a mile away. The Psychology Department occupies a row of four stately and spacious houses on a beautifully landscaped and tree-shaded suburban street. The administrative offices of the Department are at 1 Lennoxvale. While many universities in the United Kingdom have taken over former residences to meet their expanding space needs, few of the houses are as elegant, well maintained, and desirably located as those at Belfast. Moreover, the Department has another distinction with regard to space in that classroom, office, and laboratory accommodations are fully adequate to meet their needs.

The Psychology Department was established in 1946; the Chair, created in 1958, has been held by Professor George Seth since its establishment. There are now twelve staff positions on the Belfast faculty but only ten are filled. In fact, recruiting of qualified faculty members is considered by Seth to constitute the most serious problem facing the Department. In addition to being geographically removed from major British centers of teaching and research, the professional isolation in Belfast is intensified by the sheer cost and inconvenience of a ship or plane trip "across the water" to England or Scotland. The situation also is complicated by the fact that Belfast is the primary employment area for psychologists who are natives of Northern Ireland and do not wish to leave the country. Seth is quite concerned about the possible intellectual inbreeding and sterility which may result if Belfast graduates are appointed to the faculty. Last, but not least, within the past couple of years the Department has suffered the loss of at least two excellent people, one through emigration to Canada and the other to London. As a means of circumventing these difficulties and providing at least an interim solution, there is a keen interest in appointing visiting professors from the US or

other countries.

It is rather interesting that, in spite of faculty shortages, Seth does not plan to limit the number of students enrolling in psychology. At present there are over 700 students enrolled in various courses, a number which Seth claims exceeds the psychology enrollment of any department in the UK. One cannot help but speculate as to the problems which this situation will create in the future.

Reportedly, the Department is moving toward a specialization in educational and clinical psychology, even though this may not be clearly apparent when one considers the interests of the present staff. Clinical training is provided by a rather excellent Department of Psychology in the Medical School rather than by Seth's Department. Seth himself has a background in educational and child psychology, although he apparently has not been active in research for some time. He is, however, the current president of the British Psychological Society. Dr. R.G.A. Stretch, who emigrated to Canada last year, probably was the strongest and most active investigator in the Department. Just prior to his departure, Stretch finished the establishment of a complete and sophisticated laboratory for operant conditioning studies. This laboratory was equipped under a grant from the Medical Research Council for the study of the effects of stress in pregnant rats on the behavior of offspring. While this work did not really get underway before Stretch's departure, the equipment has remained with the University. One of Stretch's former students, Mr. D. Blackman, who was recently appointed to the faculty as an Assistant Lecturer, has taken over the laboratory and is doing a doctoral dissertation in the area of operant conditioning.

The Belfast Department has a relatively small but well-equipped animal facility. Mr. Robert N. Hughes, a newly appointed lecturer, recently has taken over the animal laboratory for his studies in comparative psychology. In many respects Hughes might best be characterized as a naturalist. His primary interest is in studying normal development and establishing behavioral parameters for various species of animals commonly used for laboratory research. In essence, Hughes contends that psychologists have far too little information on and understanding of the animals which are subjected to experimental manipulation in university laboratories.

Hughes recently has initiated a series of studies on exploratory behavior of the rat. At present he is observing and systematically recording the exploratory behavior patterns

of rats in novel and familiar surroundings. His apparatus consists of two identical boxes which are separated by a partition. Animals are put in one side of the box for 24 hours to become accustomed to their surroundings. After this time, periodic measures of exploratory behavior are made, and the partition separating the boxes is then removed. The primary variable being manipulated at present is the age of the animals. A single strain of rats is being used, and Hughes has gone to great lengths to ensure that the animal's behavior is not influenced by the investigator. Thus, he does not enter the animal room and all contact is through apparatus controlled from an adjoining room. Visual observation of the rats is carried out through a one-way screen. After a variety of baseline data is obtained for isolated animals, the influence of social facilitation will be examined with pairs of animals. This will be followed by studies designed to determine the influence of visual and olfactory cues on exploratory behavior.

Mr. George A. Shouksmith, a Lecturer in the Department, joined the staff in 1964, after spending a number of years at the University of Canterbury, New Zealand. While he is primarily responsible for the area of social psychology at Belfast, Shouksmith seems to have a rather wide range of interests. His early work was in the area of pilot selection for commercial airlines(1),(2). He also has worked in industrial activity sampling analysis and in student counselling. More recently, Shouksmith has turned to the problem-solving process. A recent study of individual nonverbal problem-solving has been published in Psychological Reports(3). The aim of this investigation was to determine whether nonverbal problem-solving could be accounted for in terms of simple learning. Using a binary guessing game, Shouksmith found that under simple or uncomplicated experimental conditions his subject's learning curves followed the pattern for single

---

(1) Shouksmith, G., Command Qualities in Airline Pilots, Australian Jour. Psychology, 10, 351-356 (1958)

(2) A Validatory Criterion for a Group Selection Procedure, Australian Jour. Psychology, 12, 34-39 (1960)

(3) A Sequential Guessing Game for Studying Problem Solving, Psych. Rpts., 17, 127-130 (1965)

response learning. However, as the experimental conditions grew more complex, the learning process appeared best explained in terms of Gagne's construct of "concept learning."

Shouksmith is continuing his investigation of the problem-solving process with studies in which group influence and personality variables are systematically employed. His experimental task employs a series of cards bearing pictures of buried sticks. The sticks vary with respect to the length exposed above the surface of a "ground line," and they are also slanted at various angles from the vertical. The object of the experimental procedure is to determine the total length of each "stick" through a rather complex but logical procedure. While the research has not yet been completed, it would appear that not only are there individual-group differences, but distinctions between university and secondary school level subjects, male and female subjects, and on personality variables such as ascendancy-submission, conformity, etc.

Because of time limitations, it was not possible to visit the entire staff of the Psychology Department. Although none of the individuals listed below were reported to be actively engaged in large-scale research programs, they are listed in order to give some indication of the rather heterogeneous and broad range of interests represented at Belfast. Dr. Peter McEwen, Senior Lecturer - perception; Mr. Michael F. Moore, Lecturer - mathematical psychology; Mr. Rex Mitchell, Lecturer - programmed learning; Miss Doris Staines, Lecturer - industrial psychology; and a Mr. Herriott, who is interested in psycholinguistics.

It would appear that the most active research program at Belfast is centered in the Clinical Psychology Unit of the Medical School. This Unit is headed by J. Graham White, who holds an appointment as Lecturer in the Department of Mental Health (Psychiatry Department). Basically, the Unit is responsible for providing clinical services for the University Hospital, teaching of clinical psychology students, participating in the training of psychiatric residents, and research.

The Psychiatry Department was established in 1957, with clinical psychology being added in 1959. The first students entered the program in 1961. The present staff consists of three full-time psychologists, and a fourth will be added in the near future. There are a number of part-time and medical people who also participate in the clinical psychology training program.

White's Department offers a two-year course to prepare

postgraduate psychologists for work in the Hospital Service. Suitably qualified candidates work for an MSc degree by examination, which also includes a dissertation. No doctorates have been awarded any field of psychology at Belfast.

The Department takes a maximum of four students of clinical psychology at any one time. They are sponsored by the Northern Ireland Hospitals Authority and receive probationary psychologist appointments in the Health Service. These appointments are advertised in February of each year in the British Psychological Society's Appointments Memorandum. Students sponsored by other bodies also are accepted. Candidates are interviewed in April; the course starts on 1st October. Students accepting appointments as probationer psychologists are expected, on successful completion of the course, to serve two years as psychologists (basic grade) under the Northern Ireland Hospitals Authority.

During their first year, students receive instruction in the following subjects: neuroanatomy and neurophysiology, child and adult psychiatry, the work of the National and Northern Ireland Health Services, the theory of measurement and design of clinical experiments, the psychology of handicapped children, and clinical psychology.

In the first year clinical psychology consists of demonstrations, discussions, case conferences, and supervised practice in the assessment and treatment of psychiatric patients. The aim is to provide students with the technical skills necessary for clinical work in the second year. During the second year students spend half their time, over four three-monthly periods, in supervised practice in the following health service units and institutions; a mental hospital, a mental deficiency service, a neurological and neurosurgical department of a general hospital, and a child psychiatric and school psychological service. The other half of their time is spent on research or experimental work connected with their dissertation.

Research in the Psychology Unit covers a rather wide variety of problem areas which reflect the interest of staff members and students rather than a departmental focus. White emphasizes the fact that there is no adherence to any given theoretical doctrine within the Unit; however, the visitor certainly is struck with the general organic or biological orientation which permeates both the teaching and research programs. As in many British universities, the behavior therapy fad has caught on at Belfast. These points notwithstanding, it would be a mistake to say that analytic or more

dynamic personality theory is ignored in the Department.

A study on intellectual performance, activity level, and physical health in old age recently has been completed; and a paper reporting the work has been submitted to the Journal of Gerontology. Likewise, work recently has been completed on an investigation of memory disorders in older psychiatric patients.

Considerable effort is being devoted to the application of behavior therapy to phobic anxiety and the psychophysiological concomitants both of the disorder and the therapeutic process. Mr. H. McAllister and Miss M. Olley, the other two full-time staff members in the Department, will be the principal investigators in a project which has been submitted to the British Medical Research Council for support.

The objectives of this study are threefold: to obtain a better understanding as to the nature of psychophysiological response to anxiety-provoking stimuli in subjects displaying evidence of phobic anxiety; investigate the interrelationships of various psychophysiological responses to both anxiety-provoking and neutral material; and, to evaluate change in response during the course of behavior therapy.

Two groups of patients, with established diagnosis of phobic-anxiety state, will serve as subjects. One group will receive behavior therapy and the second will act as controls. Pre- and post-treatment psychophysiological measures, obtained on both groups of subjects, will include heart rate, electromyograph, galvanic skin response, respiratory rate, plethysmograph, systolic and diastolic blood pressure. In addition, the psychophysiological battery will be run on the experimental subjects during the course of selected therapy sessions.

A hierarchy of verbal stimuli which arouse progressively increasing subjective anxiety will be constructed for each subject. A number of neutral items also will be ascertained for each individual and randomly interspersed in the hierarchy of anxiety-provoking material, with three neutral items at the beginning and one at the end of the series. Procedures for development of the stimuli material, as well as for its administration, already have been worked out in the pilot study. McAllister and Olley would seem to be well aware of the complexity and pitfalls of developing stimulus material in this fashion and have approached the task with considerable experimental rigor. Obviously, the problem has been somewhat simplified by using intra- rather than inter-subject change as the criterion.

The above material is intended to give no more than a rough idea of the range of research interests and activity in this group. The staff of White's unit are keenly aware of current literature in their areas of interest and show a statistical sophistication which exceeds that found at many universities in the UK. Their dedication and drive is contagiously stimulating; however, along with the staff of the University Psychology Department, they tend to turn out many relatively limited studies in a variety of problem areas rather than adopting a programmatic approach for intensively working in any given area. While one receives the impression that this approach to research may continue in the Psychology Department, it well may change in the Clinical Psychology Unit of the Medical School. In fact, one receives the impression that the Clinical Psychology Unit will mature into a rather sophisticated and productive organization with the passing of time.

The timeworn phrase that the only thing we need to really get off the ground is people, money, and space, is heard throughout the world. It is doubtful if many groups feel this need as deeply and strongly as the psychologists of Northern Ireland. However, even these assets, which are so often glibly considered to be the panacea of all difficulties in the scientific and academic world, will not solve the problems at Belfast. The 30-mile stretch of water from the end of the road in Stranraer, Scotland, to the beginning of the road in Larne, Northern Ireland, creates an obstacle far greater than one might imagine.

BLANK PAGE

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Office of Naval Research, Branch Office London, England	2a. REPORT SECURITY CLASSIFICATION Unclassified 2b GROUP

3. REPORT TITLE

NOTES ON PSYCHOLOGY IN NORTHERN IRELAND

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

N.A.

5. AUTHOR(S) (Last name, first name, initial)

RASMUSSEN, John E.

6. REPORT DATE 25 November	7a. TOTAL NO. OF PAGES 7	7b. NO. OF REFS 3
8a. CONTRACT OR GRANT NO. N.A. b. PROJECT NO. c. N.A. d.	9a. ORIGINATOR'S REPORT NUMBER(S) ONRL-47-66 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) N.A.	

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510.

11. SUPPLEMENTARY NOTES N.A.	12. SPONSORING MILITARY ACTIVITY N.A.

13. ABSTRACT

Review of Psychology Program at Queen's University, Belfast, Northern Ireland.

DD FORM 1 JAN 64 1473

UNCLASSIFIED

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Psychology Northern Ireland Queen's University						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

AD NUMBER: AD0804666

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 30 Nov 1966. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

No. 20-11

30 November 1966

Distributed by the
Office of Naval Research Branch Office,
London

BLANK PAGE

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

Edited by J.E. Rasmussen and Victoria S. Hewitson

30 November 1966 Vol. 20 No. 11

European Scientific Notes is Group II Newsletter type Class B periodical prepared & distributed by the Office of Naval Research London in accordance with NAVEXOS-P-35.

(b) (6)

C.T. FROSCHER
Captain, U.S. Navy
Commanding Officer

MARINE BIOLOGY

A Question of Morals or a Moral?

A recent issue of the Sunday Times carried an article, "Oysters: a sombre sexual tragedy," which concludes with a moral that cuts across all geographical boundaries and applies equally well in the US.

Ostrea edulis, the British native oyster, has recently attained the distinction of being sold for 37s. 6d. ($5.25 US) for a dozen on the half-shell. In 1864 they were quoted at four a penny, which hardly needs translation into US currency. Although a number of political scapegoats were selected as the possible cause, the industry reported that the high prices were almost certainly due to a sombre sexual tragedy which has been taking place, unreported, in the muddy estuaries and inlets of the British Isles throughout the last summer.

Early in 1966, 300 tons of Portuguese "stud" oysters (Ostrea angulata) were tenderly transplanted into British waters. Since then the vast majority of these succumbed without breeding, in spite of the persistent efforts of the oystermen and fisheries experts. It is reported that the failure of these "immigrants" to breed, or even to survive, has placed the entire home demand on the dwindling reserves of native oysters and the stiff prices are the inevitable result.

The article then provides an interesting reflection on Aristotle's view that oysters "have no sensations or sex, but arise spontaneously from the foam around stationary ships." It points out that in this particular case Aristotle was misinformed and that the British oyster is bisexual, reproducing by a "complex and time-consuming process of being male, and then female, and then male again." Portuguese oysters are either male or female and breed by a "more Latin process not too different from mammalian reproduction." The spat which result are tougher with a deeper and thicker shell.

Throughout this century pollution of the rivers and estuaries in Great Britain has been placing greater stresses on the British oyster, and in 1959, when 50,000 lusty Portuguese oysters were first imported into the River Alde in Suffolk, they did so well that by 1965 half of the oysters consumed in Britain were Portuguese imports which had been bred or fattened up in British waters.

As a result of this summer's catastrophe, however, the number of Portuguese oysters in British waters has been considerably reduced and there will be far fewer around next year. After eliminating the possibility of an oyster disease as the cause, the Ministry suggested that additional imports be avoided during February, March and April since the young breeding oysters would be weakened by lower Spring salinities even before they left for Britain. In addition to these natural cause, however, most of the Portuguese oysters come from the River Tagus on which the expanding industrial city of Lisbon is located and it seems that pollution is beginning to take its toll there.

The industry intends to attempt the importing of more Portuguese oysters next year, hoping for better results from the La Sado River. But, concludes the Times, "a sad truth appears to apply to both British and Portuguese alike: oysters and industrialisation don't mix." (J.D. Costlow)

MATERIALS SCIENCES

Ministry of Technology Materials Research & Development Program

The Ministry of Technology (MOT), headed by A. Wedgwood Benn, M.P., is charged with the responsibility for government-sponsored industrial research. When the assimilation of the Ministry of Aviation (MOA) laboratories is complete, the MOT will manage virtually all government establishments in England which have materials research and development capability. The Electrical and Chemical Plant Division of the Ministry is headed by Dr. A.C. Copisarow and the Advisory Unit on Materials is headed by Dr. M.G. Church.

The major laboratories of the MOA with advanced metal and semiconductor research include the Royal Radar Establishment (RRE), Great Malvern, the Royal Aircraft Establishment (RAE), Farnborough, and the National Gas Turbine Laboratory, Pyestock. Although MOT plans are not formalized at this point and Treasury approval has not been obtained, some of the programs have begun to function. A national center of excellence in crystal growing has been proposed for the RRE laboratories. It is hoped that quality crystals (not Ge or Si) could be produced for both industry and government laboratory use. When a new material became of economic import, the

technology for growing the crystals would be transferred to industry. There is also a plan to make the RAE laboratory into a multi-discipline center for solving critical industrial problems. The recent scaling-down of the British atomic energy programs (cuts ranging from 20-50%) provides the MOT with an opportunity to redirect efforts toward helping industry. An example of this is the National Ceramic Research Center at Harwell described by J.B. Cohen in Technical Report ONRL-43-66. Under consideration is a National Nondestructive Testing program to be directed by R.S. Sharpe at Harwell. A national center for corrosion studies at Harwell is also being organized. In addition to the AEC and MOA laboratories, those previously under the Department of Scientific and Industrial Research (DSIR), namely, the National Physical Laboratory and the National Engineering Laboratory, also report to the MOT.

Drastic measures such as co-location of scientists with common interests and capabilities are being considered. It is estimated that at least five years will be required before these vast pools of R&D capability can be reshaped to enhance British industry and ultimately shift the balance of trade in a more favorable direction. Even if the program is not completely successful, major changes in materials R&D emphasis toward industrially pertinent problems will be obtained. (P.D.Maycock)

Fuel Cell Research & Development at Compagnie Générale d'Electricité de France

Introduction - Compagnie Générale d'Electricité (CGE) with headquarters in Paris is a large, multi-plant, high-technological-base company with production and sales organizations throughout the world. Primary products involve advanced materials and electronic capabilities. This year's sales will exceed $1 billion, and total personnel exceed 55,000.

The central research facility for this vast complex is the Centre de Recherches, 91 Marcousis, Route de Nozay, about 20 miles south of Paris, in beautiful, wooded country near Marcoussis. The laboratory is about seven years old and has 400,000 ft^2 of floor space and all the usual advanced experimental equipment. It has 850 employees, 250 of whom have Master's or higher degrees. The laboratory is organized as shown in Figure 1.

The fuel cell program has recently been reoriented toward production. Dr. J.M. Auclair was the head of CGE fuel cell research for five years, but recently has been given a broader assignment which includes fuel cell electrode research, superconducting materials research, plastics, semiconductors, and development of advanced measurement techniques. Mr. Pierre Dubois, educated at Ecole Polytechnique and California Institute of Technology,

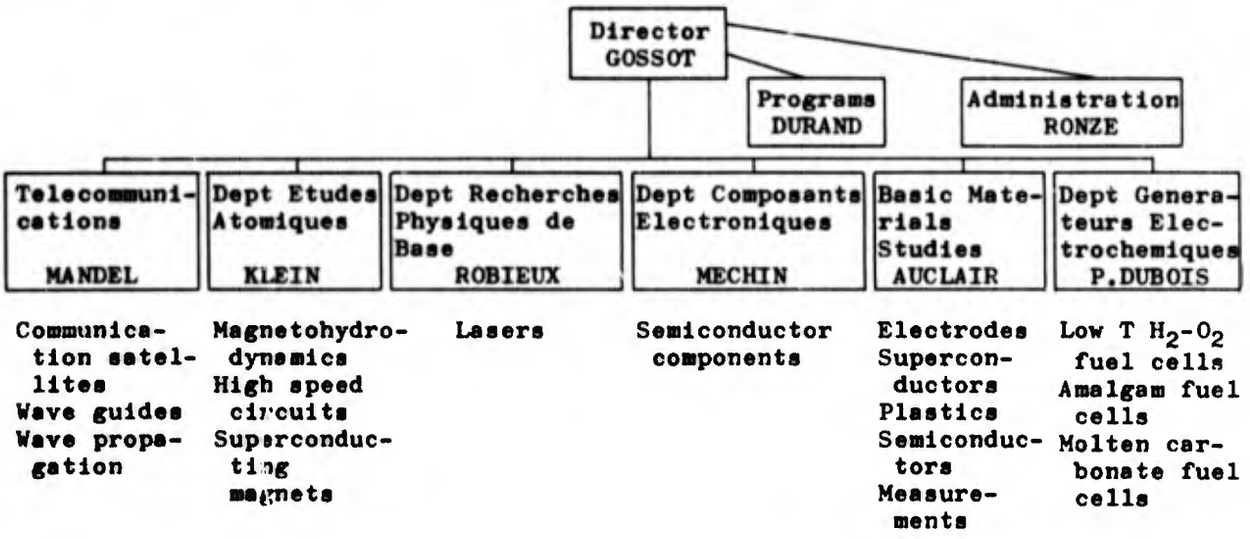


Fig. 1 - Organization of CGE Research Center, Marcoussis

heads virtually all fuel cell work and is aiming at some production within 18 months. Dubois has a total of 46 persons on the fuel cell project; thirteen are engineers while fifteen have the diploma. Auclair still has approximately 30 people working on Ag-Ni electrodes, molten carbonate electrolytes, high temperature electrodes, and amalgam systems. Six of these men are degree-holding electrochemists. Dubois has a plan for next year for 55 people. This would make the 1967 fuel cell effort of CGE nearly 90 people -- formidable, to say the least.

At the time of my visit all of Dubois' fuel cell test stations (approximately 30) were being converted from single cell testers to module test stations. Automatic readout of all test data was provided for. Construction was about 50% complete for a new fuel cell pilot production area (estimated at 40,000 ft^2).

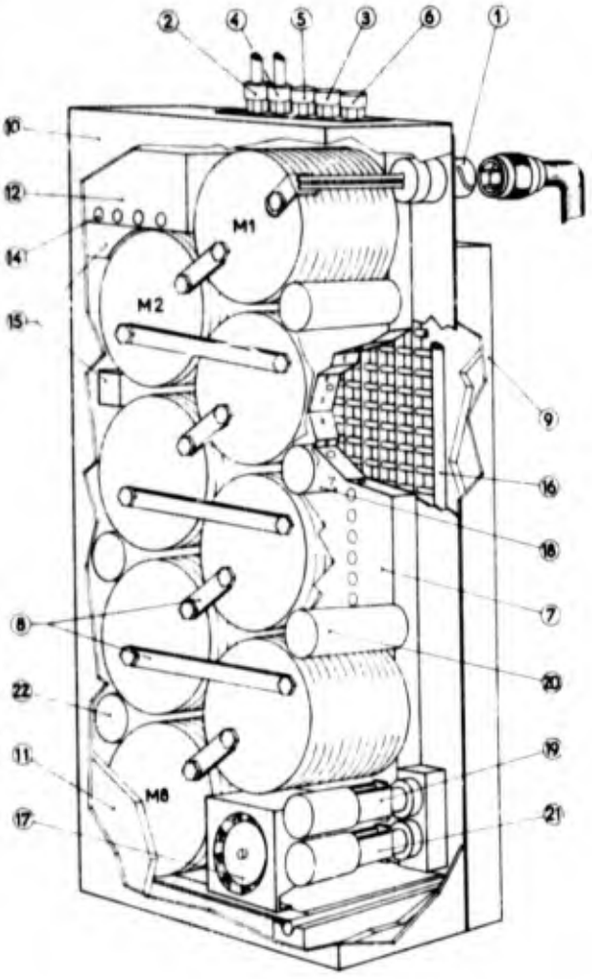
Although basic research continues on molten-carbonate high-temperature fuel cell systems, the project has gone from applied research back to basic studies. CGE collaborated with Verret and Souriau at Gaz de France on molten carbonate systems and has production rights for them. Dubois is well acquainted with the Electricite de France molten carbonate program, because he worked for Buvet and Millet. He said the molten carbonate work at Electricite de France has been terminated. CGE stopped molten carbonate module fabrication 18 months ago because of excessive corrosion. Only a defensive research effort remains.

Discussion of CGE Low Temperature Fuel Cell Systems - Present effort at CGE is aimed at finishing two systems utilizing silver-nickel (no expensive catalyst) electrodes with KOH electrolyte. Pure hydrogen derived from CaH_2 and bottle oxygen are used as fuel. The largest system will be 1-kW output with a CaH_2 hydrogen generator. The main goal is silence and lifetime. Minimal effort is being placed on weight or volume reduction. This effort is being supported by the French Army. The second system was a 100-150 W output assembly which Dubois hopes to market commercially. Both systems can best be described by considering Figure 2. The system is enclosed in an insulated case. Removable covers (9 and 10) equipped with insulation (11) allow access to the modules. The modules, M1 to M8, are connected electrically in series by metal junction bars (8). Each metal-plastic module is an assembly of elementary cells mounted electrically in parallel. A distribution plate (7) supplies the modules with hydrogen, oxygen, and electrolyte. The top of the plate carries the plug (1), the gas inlets and outlets (2 - 5) and the electrolyte filler cap (6).

The system is brought to its operating temperature ($\approx 30^{o}C$) when starting by an electric heater (14) consisting of electrical resistors situated at the bottom of the tank (12). The regulation device (15) of the heater draws, at any time, the maximum power the cell can supply without damage. An electric pump (19), equipped with voltage regulator (20), assures the circulation of the electrolyte. When the measured temperature of the electrolyte (13) exceeds a previously elected value, a regulator (22) starts the electric pump (21), which increases the electrolyte flow through the air cooler (16). If the temperature rises further, a fan (17) with a variable speed regulator (18) increases the heat exchange in the air cooler. The volume of the system shown is less than 40 liters and the electrical power at 6 V is 140 W at $20^{o}C$, and 320 W at $55^{o}C$. Normal current densities obtained are 50-70 ma/cm^2 at $20^{o}C$ and 100-200 ma/cm^2 at $55^{o}C$. The 1-kW output system uses thirty-two 11-cell modules. Life tests on the modules indicate less than 10% degradation after 4000 hours operation. After clean-up procedures, the cells returned to original operating levels. The 1-kW system was ready for checkout and the 160-W system was complete. An aspect of the CaH_2 hydrogen generator not fully appreciated when the system was proposed is that the amount of H_2O required for the CaH_2 hydrogen production is very close to the H_2O generated in the fuel cell reaction, so that electrolyte dilution is not nearly so bad as was anticipated. In fact, Dubois does not consider it a problem for the 200-hour mission time required by his 1-kW system.

The CGE effort represents a high-quality, well-staffed, multitechnology approach to entering the fuel cell business. Product division interest is evident, and it is believed that CGE is less than two years from production.

Details of CGE Process for Making Silver-Nickel Electrodes - A mixture of 30% Ag_2O and 70% Ni (reagent grade) powders with a uniform ≈ 5-μ diameter X-ray showed $5\ \mu \pm 1\ \mu$. This mixture

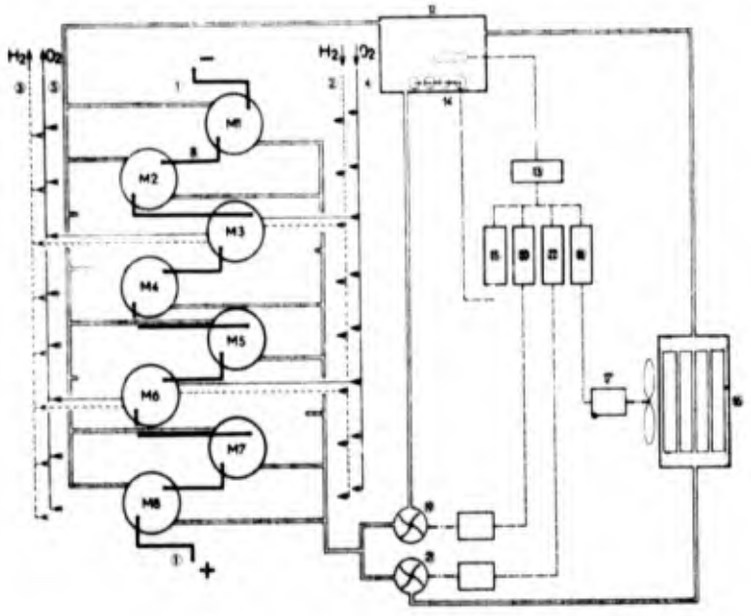


M1 -- M8: Metal-plastic modules connected in parallel

(1) Electrical outlet
(2) Hydrogen entrance
(3) Hydrogen exit
(4) Oxygen entrance
(5) Oxygen exit
(6) Electrolyte supply
(7) Electrolyte manifold
(8) Electrical connector
(9) Front cover
(10) Rear cover
(11) Insulation

Electrolyte system

(12) Tank
(13) Temperature measurer
(14) Electric heater
(15) Regulation device
(16) Air cooler
(17) Fan
(18) Variable speed regulator
(19) Electric pump
(20) Voltage regulator
(21) Cooler pump
(22) Regulator



is slurried with H_2O and air-dried on quartz dishes. This powder is then stored in bottles. A charge of powder is placed in a 1.5-ton press. It is pressed for four minutes at 1.5 tons on about 4-in-diameter discs. The result is a disc about 1/8-in thick, which is self-supporting. It is then sintered. The first sinter is in argon for three hours at 350°C. This causes the Ni to be partially oxidized by the O_2 from the Ag. The second sinter is again at 350°C for three hours in an H_2 atmosphere. Six sintering furnaces were operating with 16 plates being sintered at a time. This would provide enough for 50 complete cells per day. The 1-kW plant requires about 350 cells. These electrodes are continually improved and a goal of 10% silver content will likely be obtained. (P.D.Maycock)

Materials Science at the University of Sussex

Many conflicting views face the academician in the US engineering schools today. There is an increase in pressure from the students for greater exposure to the liberal arts (although arts students appear much less liberal in their interests in science and engineering). Yet, there is increasing interest in a unified engineering course, at least to the BS degree. While my own view has been that a deeper exposure to one field outside engineering would be very good, I wonder how much of this pressure for a "liberal" education stems from feelings of inferiority on the part of the BS candidates. After all, one has his whole life to attend evening courses and to read, although the average reading habits of our college graduates do not indicate that we have gone very far in convincing them that education is a continuing process.

More specifically -- there is also much interest in stimulating "cross-fertilization," the necessity for breaking down old lines and allowing early inter-disciplinary activity in the engineering and science curricula. Yet, traditional departmental walls usually prevent a student from hearing about any of the new fields that represent an interdisciplinary approach until it is too late. Often these areas are presented in the form of one survey course, which, after a student has committed himself mentally elsewhere, is thought of as a drudge - even before he hears the first lecture.

I have no immediate answers to offer, and indeed, many feel that the traditional lines are better and that in the long run we are going to badly damage such established areas as mineral engineering and process metallurgy. Fortunately, with the great diversity characteristic of the US educational system, it is doubtful whether any one or several plans will dominate.

The new University of Sussex offers a unique opportunity to follow the results of an interdisciplinary scheme and a unified engineering program. For this reason, I will spend as much time on the educational aspects as on the research. The school itself is an exciting one in many ways. A similar spirit of cooperation and excitement prevails on this new campus as it grows, as it did at Brandeis University in its early days, but the reader should keep in mind that this experiment is just starting.

The University and Materials Science - The original idea of a University at Sussex was suggested as early as 1911, but because of the intervening wars nothing was really done until the middle '50's, when the pressure of increasing numbers in the British university system began to be felt. Building started in the fall of 1960. Fifty students were admitted in Arts in October 1961, although the first buildings were not ready until a year later. In the engineering and sciences, building is still very much in progress with many having been occupied just this past fall and with some of the staff in "terrapins" (shells or huts).

The school itself has traditional departments only in the sense of several professors, readers and lecturers appointed in traditional fields. But these are organized into schools, such as the School of African and Asian Studies. Materials science can be entered through two schools - Molecular Science and Applied Science (and this dual entry is true of other fields as well). All candidates for the BSc degree take a common first two quarters, followed by an exam. This includes a course in "Structure and Properties of Matter," which while covering some electrostatics, mechanical behavior and atomic theory, allows the student to be exposed to various disciplines, taught both in lectures and tutorials by the experts in their field. The result has been more transfers into

the School of Applied Science than away from it. The third quarter is devoted entirely to economics as the Arts requirement. (The arts students are being introduced to science and technology in relation to their courses -- and have to write a paper. This approach is apparently not quite settled yet so the staff have the same problem of liberalizing the arts as we do!)

If the student enters materials science from the school of Molecular Science, he begins to specialize in his second year. If he is in the School of Applied Science, this second year is devoted to general engineering, with courses on electricity, electronics, analogue and digital computers (including numerical analysis), servo mechanisms, mechanics, thermodynamics, fluid flow, properties of materials, and physical metallurgy. During the third year he will specialize in materials courses in defects, deformation, more on physical metallurgy, magnetic and electrical properties and preparation and characterization of crystalline materials. In addition, he chooses two electives from a list of five, including courses on polymers and glasses.

The staff at present consists of one professor (Prof. R.W. Cahn , who has been at Sussex for 18 months, a senior lecturer (Dr. A.W. Simpson), and three lecturers (Drs.S.M. Ertl, B. Harris, and R. Doherty).

The University will reach a total of 3000 students by the fall of 1967, about 20-25% of whom will be graduate students. The first class of 13 in materials science (out of about 80 in applied science) is just starting. There are eight graduate students and three post-doctorals.

The Physics Department is quite strong in solid state with Profs. D.F. Brewer (low-temperature electrical behavior) and M.W. Thompson (formerly of Harwell and whose work in atomic collision processes is well known). Dr. J.A. Venables is a lecturer.

There are a number of interesting all-university features. Several keyboard links to large computers elsewhere are available, and others will be distributed in various buildings. A Centre for Academic Affairs is developing filming, TV, and computer teaching. Centers are also actively involved in studying science policy and planning in the UK and the developing nations.

Several interesting laboratory sessions have been planned for materials science: (1) Zone refining a dye in an organic and using optical methods to obtain the concentration-distance profile, (2) With thin-layer organic solutions sandwiched between glass slides and a thermocouple which serves both as heat and as a temperature-sensing device during a fraction of the ac cycles, cooling curves and optical observations of an entire phase diagram can be made in a few hours, (3) The Fermi energy is obtained by bombarding a substance with positrons from a source and studying the γ-ray intensity resulting from positron-electron recombination as a function of angle about the specimen.

Research Activities in Materials Science - Cahn is starting research in three main areas: (1) The effect of pores of various shapes and amounts on recrystallization, (2) Effect of stress on domain boundary orientation in CuAu, and the resultant effedt on mechanical behavior, (3) When a magnetic material is stressed in the absence of a field, re-orientation of the domains occurs, which contributes to the material's anelastic behavior up to a certain stress. The importance of metallurgical variables in determining this stress is not known, and Cahn's group is studying this.

Dr. Brian Harris, who has just returned from three and a half years with Pratt and Whitney Company in the US, will start work on composites and refractory materials.

Dr. Michael Ertl is primarily interested in thermoelectricity at the moment. He has found large variations in the thermoelectric coefficient in specimens of Bi-Sb alloys, and is trying to find out if this is due to impurities or segregation. He is also preparing Bi-insulator sandwiches, by vapor deposition, to see if the coefficient can be improved by increasing the relative importance of phonon scattering.

Dr. J. Venables in Physics is doing his work under a USAF contract. He has built a stage for the electron microscope in which samples can be cooled to 4.2°K, and bombarded in situ. This is an improved model of the device he built with Prof. Baluffi during his stay at the Univ. of Illinois a few years ago. Drift has been greatly reduced by translating the (two-tilt) stage with two quartz rods and balls. The low expansion of quartz compared to nylon (which has been used in other

devices) enables him to work at magnifications of 100,000. Helium consumption is only one liter in about three hours. Venables is continuing his previous studies of the mobility of interstitials, but in Al, whereas his former work was with Au. The technique involves measuring the temperatures at which vacancy clusters are annihilated by interstitials resulting from ion bombardment in the bulk of a wedge-shaped specimen, rather than just at the surface.

He has also successfully deposited crystals of fcc argon, which contain a density of stacking faults, quite similar to those in electro-deposited silver. Through a measurement of the fault energy, he hopes to evaluate the difference in energy of the hexagonal and fcc forms. Theoretical calculations predict the hexagonal form, and this measurement may help to guide future theoretical studies. (J.B.Cohen)

Materials Science at Imperial College

One of the most difficult areas in the ever-increasing interdisciplinary programs in universities, as mentioned above, is to arrange a good course program - graduate, or undergraduate - which meets with sufficient enthusiasm in the various departments to become a truly working program. While effort on this started later in England than in the US, there are some interesting examples in the field of materials which I have been reporting in these columns. Another is the one at the Imperial College of Science and Technology.

Imperial College is the largest technical school in the London University complex. Since 1953, the government has been pouring in large sums of money (about 100 million dollars so far), and hardly anyone can now recall a period when the continual sound of construction crews was not part of the myriad of noises in South Kensington. Many large new buildings are in full operation and others are rising steadily. With an enrollment of 3500 students, it is Britain's stronghold of technological education.

In 1963 the Departments of Chemical, Mechanical, and Electrical Engineering, Chemistry, Physics and Metallurgy, worked up an interdepartmental MSc program. This is designed primarily for those who wish to retrain themselves, for those switching fields, or for those whose backgrounds make it uncertain as to whether they will be able to go on for PhD's. (Normal PhD candidates in the various departments may attend lectures, or whole courses, and are encouraged to do so, especially if they have obvious weaknesses in certain areas. But they are still not required to do so.)

About a dozen students are enrolled this year in the first of three terms which make up a school year. Students are required to attend courses in solid state physics, statistical thermodynamics, crystallography, imperfections, and materials preparation. The Electrical Engineering Department gives 35 lectures, Metallurgy 30, Chemical Engineering 20, Physics 10,and Mechanical Engineering 5. In addition, a student may attend a course in mathematics, including, if he wishes, a quick refresher course in the first few weeks. Labs are held on techniques. A material is prepared and studied by diffraction. A thin film is deposited and studied by electron microscopy. A ferroelectric crystal is grown and domain properties are examined with a polarizing microscope. Dislocation etched pits in an alkali halide are examined, etc. Seminars with industry are also held.

In the second term, a course on mechanical, physical and chemical properties is required. And in this term, as well as the last, the student may follow courses of his own interest. Examples of such courses are rate processes, diffraction, polymers (in chemistry and mechanical engineering), lasers, electron spin, etc.

In addition, during these last two terms, the student chooses a special research topic from a large list.

Some 350 researchers work on material at Imperial (and we will report in detail on their efforts in ESN during the year). As the result of a $300,000 grant from the Science Research Council, matched by about twice as much by the University, "facilities" have been set up for polymer characterization, analytical services, mechanical testing, and crystal growth. These are directed by faculty but have a separate staff as well. Services are available free to anyone at Imperial working on materials, and a certain amount of work is done for outside groups, depending entirely on the discretion of the staff member in charge.

While there is the usual faculty group in charge of the over-all program, it was developed in detail by the

younger members, who all seem to be getting along quite well and "interacting." (J.B. Cohen)

CHEMISTRY

Inorganic Chemistry at Strasbourg

The School of Chemistry at the University of Strasbourg has just moved into a new building, or rather, two connected buildings. The undergraduate laboratory and lecture building is about 200 ft x 50 ft and five stories high. The building in which the staff offices and research laboratories are located contains approximately the same square footage of useful space, but it rises 15 stories and is oriented so as to make a T with the other building. Essentially, each professor has a floor to himself in which he places his junior faculty assistants, research workers, and research students. One predictable result has been experienced already, that is, a very few, very sensitive instruments have had to be removed from the upper floors of the taller building.

Profs. R. Rohmer (Inorganic) and J. Byé (Physical) occupy the 9th and 10th floors, respectively. Byé has been interested for 20 years in the aqueous chemistry of Mo, and has several assistants studying the nature of Mo(VI) in $NaClO_4$.aq. over a wide range of acidities, from no acid to 4-6 M $HClO_4$. His principal technique is spectrophotometry, but all of the normal physical chemical techniques are available. Rohmer is also interested in Mo chemistry but only as a part of an interest in Mo, W, Nb & Ta chemistry and their aqueous complex chemistry. As liganda he considers $C_2O_4^{2-}$, O_2^{2-}, Cl^-, Br^-, SO_4^{2-}. Recently he has done quite a bit of work in formic acid solvent in lieu of H_2O. All of the physical chemical techniques are used, spectrophotometry, conductometric studies, X-ray powder patterns of crystalline substances, differential thermal analysis, thermogravimetry, and magnetochemistry. Most recently a detailed study has been made of the visible and ultraviolet spectra of Mo(V) in Cl^- and Br^- media, using both HOH and HCOOH solvents. Also mixed peroxohalo complexes of Nb, Ta, Mo, and W have been studied. The assignment of the spectral bands appears to be very difficult in terms of the Gray-Hare model for $X_5V{=}O$. Doubt is also cast on the existance, in solution, of $MoOBr_5^{2-}$. (S.Y. Tyree)

Conference on Radiation Chemistry and Photochemistry

From 21 to 24 September 1966, an international meeting on radiation chemistry and photochemistry, organized by Prof. G. Scholes (Univ. of Newcastle upon Tyne), was held on the occasion of the 60th birthday of Prof. J.J. Weiss of that University. The Conference was held under the auspices of the British Empire Cancer Campaign, which for historical reasons was instrumental in the sponsorship of Weiss' earlier work in radiation chemistry and was instrumental in the establishment of a distinguished school of radiation chemistry at the University of Newcastle upon Tyne. The Conference was very well attended by international experts in both radiation chemistry and photochemistry and admirably served the objective of bringing together people who are experts in the two respective fields for exchange of ideas on problems of mutual interest.

Among the topics discussed that were of specific interest to the writer was a paper by Drs. A.R. Anderson and J.A. Winter (UK Atomic Energy Establishment, Harwell) on temperature effects on gas-phase radiolysis of selected polar molecules. This paper discussed in particular the effect of temperature on the yield of hydrogen from the vapor-phase gamma radiolysis of alcohol, ammonia, and water. The results showed that the G-value of hydrogen depended on temperature in such a way that there were several plateau values of the hydrogen yield. The results were interpreted in terms of the thermodynamic equilibrium involving solvation of the proton in these systems. On the assumption that the mechanism of neutralization gives rise to a hydrogen atom, the plateaus were interpreted as solvation spheres involving a specific number of solvent molecules clustered around a proton in each of these systems. The results were compared with data from thermodynamic equilibria for methanol, and general agreement was observed. For more than qualitative agreement, however, it was necessary to invoke a change in mechanism which was represented as the collisional deactivation of excited molecules.

Dr. Peter Ausloos (National Bureau of Standards) presented a paper on a

topic clearly intermediate between photochemistry and radiation chemistry -- namely, the study of photoionization of cycloalkane molecules. In this study neutral products formed in mixtures were analyzed and information derived on ion molecule reactions, fragmentation of the parent ion, and decomposition of super excited molecules (i.e., molecules excited above the ionization potential which do not ionize) from these systems. Cyclopropane, cyclobutane, cyclopentane, and the corresponding alkenes of the same empirical formula were studied under the influence of 1236 Å (10 eV) and 1050 Å (11.5 eV) radiation and were compared with data previously obtained at the Bureau of Standards on the radiation chemistry of these compounds. It is of parenthetical interest to note that in recent unpublished work from our laboratory we have obtained data from a mass spectrometric study of reactions of parent molecule ions in these systems which support, in most cases, the conclusions deduced from the analysis of Ausloos and his collaborators.

Dr. J. Bednar (Institute of Nuclear Research, Rez, Czechoslovakia) presented a paper entitled "The Optical Approximation in Radiation Chemistry." This paper was a theoretical discussion of implications of the optical approximation for primary radiation chemical yields in the radiolysis of water by gamma rays or fast electrons. This approximation is used to calculate numbers of excited molecules and ions formed by the primary processes of radiation chemistry. A mechanism is then postulated for the reaction of these species, and the ultimate chemical yields are calculated. A similar approach was a applied to a discussion of the radiolysis of liquid benzene-pyridine mixtures. Although reasonable agreement with experiment was observed in both cases, it is the impression of the writer that the level of sophistication presented in this paper is at the approximate level of discussions held in radiation chemical circles in the US four or five years ago and that it does not represent any advance in our understanding of such processes.

Prof. George Hammond (California Institute of Technology) presented a paper on the quenching of excited singlet states of aromatic hydrocarbons. Here he discussed the observation that the characteristic fluorescence of a series of aromatic hydrocarbons is reduced by the addition of conjugated dienes to the system. Quenching of fluorescence is further correlated with changes in the photochemical decomposition of these systems as anticipated by the generally accepted mechanism for these processes. At higher concentration levels of the dienes they themselves exhibit a reduced quantum yield for decomposition. These results may be drawn together by the assumption that the sensitized reactions involve triplet states of the dienes and the assumption that excited singlet states of the aromatic absorber are quenched before they can undergo intersystem crossing. A general mechanism for the quenching sensitization, and intersystem crossing reactions was proposed. It was shown how quenching data may be used to estimate the lifetime of the singlet states of the aromatic molecules -- from a study of competitive quenching by the dienes and by added oxygen.

Dr. L. Kevan (Dept. of Chemistry, Univ. of Kansas) presented a paper on the rare-gas sensitized radiolysis of liquid hydrocarbons. This was a study rather similar to previous work by the writer on the rare-gas sensitized radiolysis of gaseous hydrocarbons. In order to correlate Kevan's results, it is necessary to postulate that the energy available via charge exchange or energy transfer from each of the species R^+, R^*, R_2^+ and R_2^* (where R is any one of the rare gases) is reduced by approximately 1.5 eV as a result of solvation interaction in liquids. With this assumption in mind, a mechanism quite analogous to that previously accepted for the gas phase study correlates the results of the liquid-phase investigation very nicely. Selective channeling of radiation energy into the formation of specific products is observed, and evidence was further presented for ion-molecule reactions in the liquid phase.

An interesting paper presented by Prof. F.W. Lampe (Pennsylvania State Univ.) described a quantitative study of reaction of hydrogen atoms with NO molecules from a mass spectrometric study of the mercury photosensitized hydrogen-nitric oxide reaction system. This study showed quite clearly that the nitroxyl molecule (HNO) which is formed by the third order of reaction $H + NO + M = HNO + M$ reacts very rapidly at sufficiently high pressures

(i.e., in the presence of a third body) with two additional H atoms to form the product NOH_3, probably the hydroxyl amine molecule. Various species and intermediates interact via a rather complex mechanism, but resolution of the kinetics is possible, and rate constants can be deduced for many of the elementary reactions. An incidental by-product of the study has been the measurement of the ionization potential of the HNO radical, which is, of course, an unstable species under ordinary conditions. Dr. R.N. Schindler (Max-Planck Institüt, Mulheim) described the decomposition of electronically excited alkyl halides. This study made use of monochromatic light sources of wavelengths 2537, 2062, 1849, 1470, 1235, and 1165 Å incident on ethyl iodide, fluoride, and bromide. These molecules decompose via two principal steps in the primary act, i.e., elimination of molecular halogen hydride and rupture of the carbon halogen bond. The relative probability of the two processes depends on the wavelength of exciting light. These results are, of course, of considerable interest to the interpretation of radiolysis of these compounds. (J.H. Futrell)

MECHANICS

Ferrybridge Obituary

It was particularly significant that the seminar given by Prof. B.G. Neal, Dean of the City and Guilds College, London, on "Cooling Towers" should have occurred on the day that the report by the investigating committee on the recent Ferrybridge collapses was made public. Further, the committee, composed of Prof. P.R. Owen (Prof. of Aviation, Imperial Coll.), Prof. A.L.L. Baker (Prof. of Concrete Structures & Technology, Imperial Coll.), and Prof. A.H.Chilver (Prof. of Civil Engineering, Univ. Coll.), was in attendance and contributed much to the discussion period which followed.

Neal, in the capacity of a cooling tower designer, at first described the structures (which are used in UK to cool the water used at electrical power stations and are typically 270 ft wide at the base, 375 ft high, and roughly of hyperboloidal shape) in general and then proceeded with an analysis of the design procedure. It should be mentioned that the Ferrybridge towers were not of Neal's design.

Briefly, the results of the stress analysis showed that there could develop large tensile stresses on the windward side in the meridional direction when one combined the dead weight stress with the wind-induced stress. Where the dead weight could be prescribed quite readily, the wind velocity can be prescribed in only a statistical, time-wise sense. Since the stresses due to wind loading will vary as the square of the wind velocity, it becomes apparent that the design wind condition must be carefully examined.

As an added complication in picking the design wind condition, it was pointed out that there were conflicting estimates of the variation of wind pressure with height along the tower. A typical profile of the wind velocity near the ground shows that the velocity varies as the height of the ground, raised to the power 0.1 or so. One might conclude from this that the wind pressure should increase with height, raised to the power of the square of 0.1. However, it was later shown that in wind tunnel tests of isolated towers the pressure was approximately constant with altitude.

From the point of view of stability, some experiments were undertaken to determine the deflected shape during buckling of an isolated tower in a wind tunnel. As the towers were observed to deflect near the top in a heart-shaped cross-sectional pattern (with the two lobes oriented to windward), which did not correspond to the observed mode of failure (a collapse of the lower section of the windward side), it was concluded that stability was not critical.

As a final study, one of Neal's students undertook the experimental determination of the frequencies and mode shapes of free vibration of a cooling tower separated at a number of discrete points by simulated columns. It was of interest to see if the lowest natural frequencies would lie in the region of frequency with which vortices are shed from a right circular cylinder.

A model was constructed by electroplating copper on a perspex core. It was found that the lowest natural frequency of the fully-supported model corresponded to a wind velocity of 200 mph. This velocity was computed using the analysis of A. Roshko. However, if some of the supports were removed from the windward side, symmetrically about the wind direction.

the following equivalent wind velocities were observed:

On supported arc length (degrees)

0	18	36	54	72	90
Velocity (mph)					
200	180	140	100	70	50

Such an unsupported arc could presumably represent a horizontal crack near the bottom edge of the tower.

Thus, it was concluded that the failure of the Ferrybridge tower was due to picking too low a wind velocity as the design condition and augmenting this with too low a safety factor.

In the discussion period, Chilver asked if the properties of concrete were acounted for in the design process, i.e., shrinkage effects. It seems that cracks are being observed in practically all existing cooling towers. In some there are pronounced vertical cracks extending from the point of support at the bottom.

Baker added that the cracks might be due to the uneven drying process. He suggested that some steel reenforcement be used to limit the width of the cracks as well as making a double layer of reenforcement so as to prevent the cracks from extending through the thickness.

In a final comment, Owen suggested that the vortex shedding produces an oscillating circulation pattern which would move the point of maximum wind-induced stress over a rather wide circumferential direction. No doubt Owen will have something further to say about this in his seminar, "Flow about a Group of Cooling Towers," to be given in early November.
(H.E. Williams)

MISCELLANEOUS

Walk or Ride?

Mrs. Barbara Castle, the Minister of Transport, is concerned about the congested state of traffic in London, and the local newspapers have given a lot of space lately to discussing various proposals to alleviate the jam. Anyone who rides a bus through the middle of town, as I occasionally do, must often wonder whether it isn't quicker to walk. I am convinced that it is. Last week, while my big red chariot sat motionless at a clogged intersection, I resolved to make a scientific inquiry into this question. A scientist ought to participate in examining the central public issues of the day.

What is the average speed of a London bus?

The naive investigator, approaching this problem, might be tempted to time a number of buses over a measured course. Needless to say, this procedure can be rejected out of hand. It lacks style; it is not sporting, for you are certain to get the right answer; it calls upon no arcane store of knowledge worthy of a true savant. Indeed, there is little to recommend it except directness, simplicity, and accuracy. Therefore, I adopted for my work a more elegant procedure which is free from these objections.

My office overlooks Oxford Street, a typical crowded thoroughfare. From the window, I can see the entire block which is bounded by Orchard Steet on the west and Duke Street on the east. This stretch is about 440 feet long. Armed with chronometer and teacup, I recently made a record of the number of eastbound buses in the block at 15-second intervals. This operation is called "taking the data." (Never mind what I'm going to do with these numbers; I'll get to that in a minute.) Ideally, since my method is a statistical one, the sequence of observations should be prolonged indefinitely -- that is to say, it should extend over the whole duration of the tea-break. However, this phase of the research was terminated after 40 minutes by the passage of a spectacular pedestrian in a miniskirt who distracted my attention from these scholarly labors. Hence, a finite sample will have to suffice.

From the analysis of the statistical fluctuations in the sequence of counts, it is possible to compute a parameter P which defines the probability that a bus observed on any occasion will have passed out of the block before the next observation is made, t seconds later. The theory for this was worked out by Smoluchowski in 1914 without any help from me; the essential formula for our present purpose is $P = \Delta^2/2N$, where N is the average value of the variate and Δ^2 is the mean square difference between successive values (separated by a uniform interval t). The following table gives experimental values of P for different time intervals as obtained from the bus-counting data:

t, sec	P	P/t, sec^{-1}
15	0.32	0.021
30	0.61	0.020
45	0.82	0.018
60	0.86	0.014

To complete the analysis, it is necessary to relate P to the speed of a bus. The asymptotic solution in the limit $t = 0$ can be shown to be $P = vt/a$, in which v is the average bus speed and a is the length of the block. The rather tedious proof of this result is left as an exercise for the reader, who should be willing to take my word for it anyway. By extrapolation of the tabulated values of P/t to $t = 0$, it is now a straightforward matter to establish that $v/a = 0.022$ sec^{-1}. The average speed of a London bus passing my office therefore comes out to be 6.6 mph. I'll bet Mrs. Castle didn't know that!

Certain of my colleagues maintain that this finding refutes my own contention that I can always get from A to B faster on foot than on a bus. They base this conclusion on the fact that my best walking speed, clocked en route to the pub on a clear track, is barely 4 mph. So it's quicker by bus, they say. Are they right? Can I be mistaken? Of course not. The explanation, although absurdly simple, is an instructive object lesson in the proper interpretation of experimental results. Where my friends went wrong was in failing to recognize that my experiment gives the speed of an average London bus. The clear conclusion is that when I take a bus, I always happen to catch one that is destined to travel at less than average speed during the time I am on it. This may seem an unlikely conspiracy of events -- as indeed it is. But these long runs of improbable happenings are bound to occur. For example, everyone knows that a chimpanzee, banging away randomly at a typewriter, is dead certain to reproduce eventually all of the books in the British Museum, correct to the last comma. Oddly enough, this interesting fact has never yet been demonstrated experimentally, so far as I am aware.

Tomorrow I have an appointment with the Director of the Regent's Park Zoo. (J.A. Bierlein)

New Campus of the University of Surrey

The student dormitory buildings at the new campus of the Univ. of Surrey (formerly Battersea College of Technology) in Guildford, Surrey, will have a number of unique features. First, it was suggested by the present Dean of Students, Dr. M.M. Clark (a member of the Mathematics Dept. who is active in relaxation methods as applied to elasticity) that there be no wardens quartered in the buildings. In his opinion, students should be encouraged to develop their own dormitory regulations and also do their own enforcing -- up to a point.

Second, the bedrooms on each floor enclose a central kitchen area. This led to the description in the press that the dormitories feature "farmhouse" kitchens where students can make their own breakfasts. It should be noted that dining facilities are available in adjacent buildings, but this new kitchen feature should accommodate students' individual tastes and preclude the necessity of going out into the weather.

The first 1200 students will move to the Stag Hill site, below the new Guildford Cathedral, in October 1968. The first group will include the Engineering Dept., which will occupy the ground and first floors of the academic block. The Mathematics Dept. will also be in this group, but will spend part of their time commuting to Battersea to provide mathematics courses for those departments scheduled to move later.

The Administrative Building will be situated immediately above the academic block on the hill with refectories on each side. The dormitories lie between the Administrative Building and the Cathedral. There will be nine four-storey blocks of dormitories built in the first phase. A typical floor plan shows four suites of bedrooms for four students each, adjoining toilet, bath and laundry rooms, and the central kitchen. The pattern differs in some buildings in which flats have been provided for married students and junior staff members. (H.E. Williams)

PHYSICAL SCIENCES

Humidity Measurements at NDRE

Dr. Dag T. Gjessing of the Norwegian Defense Research Establishment, Kjeller, is well known for his investigations of radio-wave propagation in the troposphere. For these studies a new fast response technique has been developed for measuring water vapor content in the atmosphere.

The technique is based on the measurement of the difference frequency between two stable and closely separated (in frequency) crystal oscillators. The crystal used for sensing humidity is coated with gold and then with a very thin layer of BaF_2. Air

enters the crystal cartridge through a small hole and, since water vapor controls weight, therefore influences the crystal resonance frequency. Preliminary experiments indicate that water vapor can be measured with response times as short as a few milliseconds.

The measurement device employs an 8-Mc oscillator and an oscillator at a frequency approximately 1 kc removed from 8 Mc. Difference frequency, sensed with a frequency discriminator and a diode, is used to provide high speed measurements on atmospheric humidity. (M.W. Long)

Annual Meeting of the German Physical Society, Munich, 1966

To observe the different styles of running a scientific meeting in a rather heterogeneous continent like Europe and to compare it with the American way is a rather illuminating experience. From these variations one is almost tempted to derive conclusions about the general approach to science and the standing of scientists and scientific work within the different European societies.

The structure of the German Physical Society is very similar to the organization of the American Physical Society. In addition to the regional sections within the Society, there exists also a typical structure which resembles the Divisions of the APS. Called "Ausschuss" or "Fachgruppe" in German, they unite within the Society the physicists working in the fields of high polymers, acoustics, high frequencies, mass spectroscopy, nuclear physics semi-conductors, metal physics and magnetism, respectively. This similar organizational structure, however, has not hindered the German physicists from establishing their own and rather different mode of communicating with each other in the conferences of their Society.

There are sectional meetings within the German Physical Society and there are divisional meetings in the spring. It is at these sectional and divisional meetings that the new results of physical research in Germany are reported. The big annual meeting in the first half of October, uniting once per year all the members of the Society, is kept entirely free from the communication of new results. There is nothing that compares to the "contributed papers" at a meeting of the APS, and only a small part of the time is devoted to something that can be compared to our "invited papers." The tendency of the annual meeting of the German Physical Society, in addition to the usual social and professional benefits of talking to friends and colleagues, is exclusively educational. The meeting is supposed to provide a forum for a communication not so much of the same, but of different fields of specialization. It gives the opportunity and an incentive for the physicist to continue his education and to bring himself up-to-date in fields other than his own.

This educational function is mainly accomplished by "plenary lectures" which take up the whole morning and therefore approximately half of the total available time. Lasting one hour each, they are usually brilliant from a pedagogical point of view and reflect the best of a long-standing tradition of university teaching. Content and level of these lectures are best compared to the articles in "Scientific American" - possibly making up for a shortage of publications of this type in a country in which the specialist still feels no real obligation to bring his science down to the popular level. This year, the subjects of these lectures selected to bring the audience up-to-date, covered the Gunn effect, holography, cybernetics an interfacultative science, molecular structure and information transfer in biological systems, physics of weak interactions, experimental tests of time reversal, new results of the physics of many body-systems, and new results on quasars, on moon and planet surfaces.

The afternoons are set aside for meetings of the Divisions. The nucleus of the four simultaneous sessions is the "Fachbericht" (topical report), which comes close to the "invited paper" of the APS meetings, but is slightly more general. Presented by specialists, of which some were invited from other countries, these Fachberichte usually start out with a review of his field and conclude with a summary of the contributions from the author's institute.

In keeping with the educational tendency of the meeting, each "Fachsitzung" (topical session) is opened by an introductory lecture, in which the basic facts and definitions of the field are explained to the outsider, so that everyone can understand what is then to follow in greater detail. The full program of these topical sessions provides a compendium of

subjects which are of interest to physicists in Germany these days and provides a guide to "Who-is-doing-what," therefore, the program is listed in a detailed conference report available through this office (ONRL-C-24-66).

Since this was a joint meeting together with the Austrian Physical Society, concessions had to be made to their needs. Thirty "Kurzvorträge" (short papers) were submitted exclusively by Austrian authors, mostly from the Atomic Institute of the Austrian Universities, Vienna, and the Reactor Center, Seibersdorf. These were similar to contributed papers, but apparently not much importance was attached to them, in that the solid-state physics papers, for instance, were scheduled as sessions parallel to the solid state "Fachsitzung."

There are three more things of a German Physical Society meeting worth mentioning. The first, Americans also have; the second, we perhaps don't need; and the third we don't have, but perhaps should consider copying.

1. Similar to our own program, one morning is set aside for physics teachers. This year one-hour lectures were presented on noise problems, extraterrestrial physics, the physical aspects of music, and solid noble gases, each being delivered by first-rate authorities in the respective field.

2. The "Evening of Contact," bringing together young students and physicists with a group of senior scientists from the universities, is possibly justified in view of the strong vertical structure of German scientific organization and hierarchy. It provides the opportunity to bridge the gap between the two groups of a community in which it is still somewhat unusual for the younger member simply to button-hole the older one informally outside of the conference rooms.

3. It seems worthwhile to consider copying the "Evening Lectures," which have somewhat the formal and grandiose air of a scientific show. Two were given in plenary and public session in the big conference room of the Deutsche Museum. The first one, historically oriented, was by W.Gerlach (Univ. of Munich), on the "Early history of the physics of light and colors," and the second one, with experiments, by H. Auer (Univ. of Munich) on radio astronomy.

The high standing of scientific, in particular academic, activity in German society was not only expressed in a widespread newspaper coverage of the meeting, but also in a very formal opening session of high ceremonial value. A symphony orchestra played Bach at the beginning of the usual sequence of "We-are-so-glad-you-are-here-and-we-hope-you-enjoy-yourselves" speeches, which included addresses by the Federal Minister for Scientific Research and the Bavarian Prime Minister.

The opening address of the President of the German Physical Society, Prof. W. Finkelnburg reflected some of the difficulties which the universities encounter in post-war Germany. In an attempt to have the old academic values survive unchanged, the German university finds itself in a dilemma between tradition and progress, between keeping up esoteric demands and giving in to the needs of society. The progressive element in this struggle is the "Wissenschaftsrat" (Council for Science) a body established by administrative agreement between Federal and State governments, consisting of representatives of both, as well as delegates from the institutions of higher learning. Although no executive power is vested in this Council, its periodic "recommendations" for improving the higher educational system are somewhat hard to ignore. Its latest report recommends not only a restriction in the length of courses and thesis work, but suggests even a mandatory expulsion of "external students" who misuse the traditional academic freedom of German universities. Orienting themselves predominantly on the image of a university as seen by the liberal arts-faculty, rectors and professors consider such a recommendation as lack of confidence in their own judgement and as an attack on the "concentrated leisure" which is the embodiment of intellectual activity.

Finkelnburg in his opening speech took side against any restrictions in the length of the thesis work, but recommended strongly a larger influence of the natural-science faculty in shaping educational policy, which is at the present still dominated by the liberal-arts faculty.

The formal address of the opening sessions was given by C.F. von Weizsäcker (Univ. of Hamburg), physicist and philosopher, famous for his contributions to the philosophical foundation of physics. He stated in the

beginning that the title of his lecture, "Unity of Physics," seemed somewhat inappropriate in view of the diversity of specialists sitting in front of him. Nevertheless, he claimed, the unity of physics seems to be just around the corner. Elaborating on this statement, he described how the history of physics proceeds in cycles, starting from unity, developing into complexity and returning to unity. Atomic physics, in particular, is a good example for this progress in cycles. The complexity of present day physics is therefore nothing but a transitionary phase, almost a crisis situation, which will be overcome like a sickness is overcome by the following recovery.

In its early phases, science establishes certain laws on a rather naive or strictly philosophical basis. As it progresses, certain modifications and additions are necessary, which form the bulk of the complexity and specialization. By probing progressively into depth, however, the limits of our recognition are realized and science can be seen as a whole, returning thereby to unity. Such an argumentation depends, of course, upon the possibility that the limits of physics, for instance, can actually be recognized. Is physics a finite problem, or are new views and avenues of progress opening up every time we reach a borderline? From every day's experience, the physicist is inclined to believe that there is no final borderline, but according to Weizsaecker, he is in the position of a man awakening five times during the night and concluding that, therefore, it will never be daytime again. It is a built-in feature of a physical theory that it can give no reliable information on its own limitations. Only the next step after modifications and expansions can outline these limitations by looking back to the previous stage. Descending from the philosophical level onto the level of actual physical theories, Weizsaecker returned to his original claim of a future unity of physics. By expanding the present quantum mechanics to the areas of very large and very small dimensions, he has hope for a unification of quantum theory, cosmology and elementary particles, in particular.

Weizsaecker's lecture was apparently designed as a challenge rather than an attempt to unite everyone in the audience in whole-hearted agreement. Accordingly, the discussion was vivid and quite up to the demanding level of the presentation. It can be expected that the lecture will be published in detail in scientific and philosophical journals, so that the interested reader will have an account more competent than this amateurish summary.

Weizsaecker's lecture provided the link between the political and the professional part of the opening session. After the award of the Max-Planck-Medal of the German Physical Society, the prize lecture of Prof. G. Lueders (Univ. of Göttingen) on "The method of the correlation functions in the theory of superconductivity" guided the audience all the way into physics. From then on the remainder of five days was devoted to the serious business of educating each other in what modern physics has to offer. (B.O. Seraphin)

PSYCHOLOGICAL SCIENCES

Third Anglo-American Symposium on Military Psychiatry

On 16 November the British Army was host for the third of what has become an annual UK-US meeting on military neuropsychiatry. The first Symposium in this series was sponsored by the Royal Air Force and the second by the U.S. Air Force. Brigadier J. McGhie, Director of Army Psychiatry, was responsible for organization of the program and served as chairman. In addition to representatives of the UK and US military psychiatry programs in Europe, this year's conference was opened to personnel from the Canadian and Australian Armed Forces. In all, approximately 50 psychiatrists, psychologists and social workers attended the one-day meeting.

The Symposium was held in the Royal Army Medical College, a late-Victorian structure situated on the banks of the Thames, in the heart of London. From the outside the College is not particularly imposing, and the interior is characterized by high ceilings and a maze of passageways, classrooms, and small offices which are the inevitable result of modifying old buildings to meet changing requirements that accompany the passage of time. There is an exception, however, to this sweeping generalization. The reception room, main dining room, and anterooms of the Headquarters Mess contain all of the heavy paneling, oil paintings, silver, and trappings

associated with the formality, dignity and grandeur of the Victorian era. Of particular interest is a small room devoted to commemorating Royal Army Medical Corps officers who have been awarded the Victoria Cross, Britain's highest military decoration.

The program differed from those of previous years in that fewer theoretical and/or research papers were presented. While the program as a whole tended to lack a number of scholarly characteristics which usually typify professional meetings of this nature, its focus was quite appropriate, as this was not a meeting of a learned society. The majority of participants were practitioners faced with problems of enhancing the contribution of psychiatry to their respective military services. There are many professional societies, international congresses, and journals which serve as vehicles for theoretical and research contributions; this Symposium filled a gap in providing a platform for the military psychiatrists to exchange views with colleagues from other countries on the problems of daily practice.

A brief and sincere welcoming address was given by Major General Morrison, Director of Medicine of the College. This was followed by equally brief introductory remarks by Brigadier McGhie. The program per se consisted of seven formal papers and a viewing of the controversial film "The War Game." The majority of the presentations were concerned with describing the development and functioning of clinical programs in a variety of service settings. One scheduled paper was canceled at the last minute because of difficulties in obtaining a security clearance. A discussion period was scheduled following each paper, but scheduling problems required that this be limited or omitted for several of the papers.

Wing Commander A.B. Goorney (RAF) presented the first, as well as one of the more intriguing papers of the day, entitled "The Treatment of Flying Phobias and Allied Conditions in Experienced Aircrew." Goorney, who is a qualified aviator as well as a fully-trained psychiatrist, described a current clinical study utilizing behavior therapy in the treatment of fliers suffering from anxiety. The study is not far enough along to warrant drawing conclusions, and it actually may have been somewhat premature to report on it at the Symposium. At the same time, it is also sufficiently novel to warrant more than passing comment.

Approximately one-third of the psychiatric workload in the RAF program centers around problems of flying which are directly or indirectly related to anxiety. Somewhat less than 20% of patients in this category must be grounded permanently, including officers with long and extensive flying experience. This situation is not new in the RAF (or any other air force) and has been approached for years with orthodox treatment procedures. The therapeutic goals usually involve reduction of environmental stress with ultimate assignment to a less stressful form of flying. While the more traditional approaches may be successful, it frequently is difficult to restore the patient to flying his original type of aircraft, and long-term follow-up has disclosed that problems of anxiety generalization are not uncommon.

Goorney is working with individuals who have not responded to traditional treatment and are scheduled to be grounded. Thus, his subject population is composed of patients who have clearly and unequivocally been identified as losses to the RAF flight program. The treatment is carried out in two distinct phases, the first of which is on the ground and the second in the air. At the beginning of the first phase, a hierarchy of stress situations related to flying is developed from interview and case history material. The patient then undergoes a sequence of therapeutic sessions aimed at progressive desensitization to this hierarchy of stress situations. After the patient has been able to imagine or verbalize his feelings about the most extreme of the situations without experiencing conscious anxiety he is introduced into the second phase of treatment.

The flying phase of the treatment is varied according to both the patient's background in aviation and the nature of his complaint. The underlying principle, however, involves moving through a carefully planned sequence of steps which culminates in the subject being able to carry out the type of operational flying for which he was trained. A hand-picked group of pilot instructors work as co-therapists in this phase of the treatment. The second phase essentially duplicates the ground desensitization in the air, using the

type aircraft in which the symptoms originally occurred. The ultimate step in the desensitization hierarchy may involve (and actually has in one case) the performance of combat maneuvers in a jet.

To date, Goorney has completed the treatment of five patients with this method, four of which were restored to full flight status (three pilots and one navigator). The fifth subject, a navigator, had his fear of flying reinforced when the pilot co-therapist attempted to short-cut the progressive desensitization and prematurely subjected the patient to a series of combat maneuvers. All of the successful cases have been highly experienced pilots with considerable experience and good pre-illness performance records.

It is unfortunate that more time has not elapsed since Goorney started his study, as little can be said about prognosis in this treatment program or about displacement of symptoms. The first subject, a flight instructor, has been back at duty for only three months, and the last successful subject less than one month. However, all four are reportedly totally asymptomatic and functioning without impairment. No claims are made that this approach is the panacea for disorders of this nature or that the recovery will be sustained over any significant period of time. Goorney has adopted an empiricist's outlook in his study. On the basis of his experience to date, three factors enter into successful application of the treatment program: selection of patients, the timing in transition from the ground to the flying phase of the treatment program, and the requirement that the therapist be a trained flyer. The method is proposed for use only in the case of experienced aviators who have failed to respond to more conventional forms of psychiatric treatment and whose potential value to the service justifies the rather considerable expenditure of time and money which is required. One might predict that it will be some time before high performance jet aircraft and aviation gasoline become stock items along with meprobamate in the medical supply catalogs; however, the old practice of requiring an aviator to fly again immediately after a traumatic experience certainly has become markedly more sophisticated with the passing of time.

The second paper in the morning session was presented by Lt.Col. T.B. Stephens, RAMC, a staff psychiatrist at the Royal Army Medical College. Stephens' paper, "The Psychiatrist With a Special Force In An Overseas Theatre," described a visit he made to Aden in connection with a survey of morale and effectiveness of British troops stationed in this rather desolate and primitive outpost. Much of the presentation was concerned with relating the approach used in collecting information from commanding officers, medical officers and troops, along with the pitfalls which the psychiatrist meets in the unstructured field situation. Stephens used colored slides to illustrate the nature of the stresses which troops encounter in Aden and the conditions under which they must live. Psychiatric referral and admission rates reported by Stephens did not appear out of line with service in this environment; and, as might be expected, they tend to rise during times of increased tension.

Major R.S. Britton, RAMC, described the development and present operation of a child guidance clinic in his paper, "Organization of a Child Psychological Service in an Overseas Theatre." Britton, who is currently serving in Germany, presented some interesting summary data on the differences in family background and reasons for referral of children between his clinic and in England. Generally speaking, delinquency and truancy are less common complaints among children referred in the overseas clinic, where approximately one-third of the referrals were related to educational problems and enuresis. Somewhat surprisingly, 74% of the mothers in Britton's sample had at some time or another received psychiatric treatment. Further, 26% of the fathers had been raised either partly or totally in foster homes.

Squadron Leader A.S. McVicar, RCAF, was the only Canadian speaker on the program. His paper, entitled "Community Care In A Service Environment," described the development of an admirable preventive psychiatry program in a Canadian Air Force community near the German-French border. Essentially McVicar's approach is to hold "community conferences" with chaplains, administrative officers, medical officers, and others who are concerned with human problems. The conferences are focused on increasing perceptiveness of problems faced in this environment and changing negative attitudes through group dis-

cussion. The major meetings are planned on a semi-annual basis, although smaller groups now have evolved which meet more frequently. Separate seminars also are held for general medical officers. McVicar's paper was particularly complete and objective, and he very candidly discussed resistances encountered, as well as his own mistakes and frustrations in the program. As in any approach of this nature, it is very difficult to arrive at an objective assessment of the definitive contribution which the program is making to a constantly changing military community. However, if acceptance by the group involved serves as any criteria, McVicar appears to have done an excellent job.

Lt.-Col. B.L. Livingston, the neuropsychiatric consultant for the U.S. Army Forces in Europe, outlined the Army's preventive psychiatry program in his presentation "Mental Hygiene in the American Army." Livingston's paper was well organized and well received. Although the content of the paper was familiar to the US participants, it was of obvious interest to their colleagues in the British forces.

Surg. LCdr A. Scott-Brown, RN, spoke on "Psychiatric Problems of Personnel Serving in Small Naval Ships." The primary thesis of Scott-Brown's paper was the need for medical officers on small ships to recognize early signs of psychiatric disturbance and take action before the illness has assumed more serious proportions. It is his contention, based partially on his own experience in small ships, that young medical officers fail to recognize many cases of psychiatric illness. To a certain degree it is considered that this problem arises because the medical officer tends to become an integral part of the small ship crew and lacks the emotional and professional detachment which is important in perceiving early signs of illness. However, far more important is the lack of sensitivity to and orientation toward detection of psychiatric disorders.

Interest in this problem has led Scott-Brown to collect data on the source of referrals seen at the Royal Navy Hospitals, Haslar, Portsmouth, and Plymouth. The incidence of patients who ultimately were referred to the psychiatric consultant at these hospitals is greater for small than for large ships. The highest incidence of claustrophobia was found in men who served in submarines. However, it is interesting to note that 100% of these patients were individuals who had <u>not</u> volunteered but were assigned to submarines. (The Royal Navy assigns men to submarines as a routine personnel action when an insufficient number of volunteers is obtained to fill quotas.)

The last formal paper of the day, "Psychophysiological Effects of Intercontinental Flight Through Multiple Time Zones," was presented by Major S.L. Freud, a USAF psychologist. Freud discussed a series of studies carried out while he was assigned to the FAA on disruption of circadian rhythm induced by jet flights. No attempt was made to present the detailed results obtained on the rather extensive psychological and physiological measures used in the study. Rather, the data were presented in summary form with an emphasis on the practical significance of the findings. As the conclusions derived from this research are fairly well known in the US they will not be repeated here; it is sufficient to say that all available evidence indicates there are certain types of activities, particularly in the area of high level abstraction and negotiation, which should be avoided by the international traveler passing through more than three time zones until his circadian rhythm becomes readjusted. Freud began his presentation by quoting from the Declaration of Independence - a somewhat novel approach in the home of British Army medicine. Even though this was the last paper of the afternoon, the attention of the audience certainly was captured by the opening remarks. Exactly the right balance between data and conclusions was maintained; which, combined with a lucid and humorous form of delivery, made this the most enthusiastically received and discussed paper of the meeting.

The last hour of the seminar was devoted to a viewing of the controversial movie "The War Game." This 50-minute film, made by the BBC, has been banned from British television. The plot of the film in concerned with a hypothetical atomic bomb attack on England. The story begins with the early warning phases before the attack, progresses through the blast, and portrays the destruction, physical injury, death, and breakdown in social order following the catastrophe. The death and destruction scenes are extremely realistic, and the acting out of psychological response to the

to the disaster and the mass social disorder which follows is superb. It was interesting to observe that the Symposium audience, composed primarily of experienced military medical officers, sat in absolute silence at the end of the film. There is no question as to its power and impact. Brig. McGhie led a brief discussion as to the appropriateness of this movie for viewing by unsophisticated audiences. The general consensus of the group was that it should be shown only to selective audiences because of its shocking realism.

The seminar was closed by McGhie, who, because of time limitations, did not make the formal address which had been scheduled in the program. After announcing that the USAF would be host to next year's Symposium, McGhie thanked those who had assisted in planning the program and indicated in passing that the goal had been to present a full day of interaction on "practical military psychiatry." On the basis of comments overheard at the delightful cocktail party given by the Royal Army Medical College at the close of the meeting, there is no question about the participants considering that the goal had been achieved. (J.E.Rasmussen)

NEWS AND NOTES

The Second European Symposium on Marine Biology will be held at the Biological Station, Espegrend, Blomsterdalen, Norway, 24-28 August 1967. The general topic of the Symposium will be the importance of water movements for biology and distribution of marine organisms. Within this general topic will be included a consideration of the measurement of water movements, the ecological and physiological effects of water movements, and water movements and distribution. The announcement invites papers within the general topic, stressing that new results should be presented. Presentation will be limited to 20 minutes with additional time alloted to the discussion. Papers and discussion remarks may be presented in English, German, or French, but simultaneous or other translation services will not be available. An abstract of the paper should be submitted before 1 August 1967 to permit time for duplication and distribution. Papers submitted at the Symposium will be published in Sarsia, and thus it is essential that "finished" manuscripts be delivered at the meeting.

Individuals interested in further details or application forms should write: Prof. H. Brattström, Director, Biological Station, Espegrend, Blomsterdalen, Norway. (J.D.Costlow)

The British Government White Paper on the decimalization of the £ has now been published, and arguments were being voiced on the day of publication, not as to whether decimalization should be adopted (this has already been accepted as a necessary evil) but whether a hundred pennies should be worth ten shillings or a pound. (The Chancellor of the Exchequer in a television interview dismissed the suggested substitute of the word cent for penny as "too American.") A Decimal Currency Board will deal with the practical problems associated with switching from £ s d to the new £, which is predicted to take place in February 1971. The Chairman of the Board has been named and his salary fixed -- £3500 (or 350,000 new pennies).

Dr. W.C.E. Higginson, Reader in the Faculty of Science at Manchester Univ., has been appointed to the Third Chair of Chemistry at Hull Univ.

Dr. B. Rose has been appointed Head of the Nuclear Physics Division of the UK Atomic Energy Authority in succession to Dr. E. Bretscher, who has retired.

Prof. I. C. Goddard, Professor of Mathematics at the Univ. of Tasmania, has been appointed Professor of Mathematics at Salford Royal College of Advanced Technology - the proposed new Univ. of Salford.

R.A. Cawson, Senior Lecturer, Guy's Hospital Medical School, London Univ., has been appointed to the Chair of Dental Medicine there.

R.P. Bell, Fellow and Vice-Master of Balliol College, Oxford, has been appointed Professor of Chemistry at the Univ. of Stirling.

F.G.T. Holliday, Lecturer in Zoology at the Univ. of Aberdeen, has been appointed to the Chair of Biology at the University of Stirling.

Dr. A. Korner, Lecturer in Biochemistry, Cambridge Univ., has been appointed Professor of Biochemistry at the Univ. of Sussex.

Dr. W.L. Wilkinson, of the Atomic Energy Authority, has been appointed to the second Chair in Chemical Engineering at the Univ. of Bradford.

Dr. F.M.J. Cornish, Senior Lecturer in Applied Mathematics at Leeds Univ., has been appointed Professor of Mathematics at the Univ. of York.

Prof. H.C.H. Gurney, Professor of Civil and Structural Engineering at the University College of South Wales and Monmouthshire, Cardiff, has left to take up an appointment as Prof. of Mechanical Engineering at the Univ. of Hong Kong.

Dr. H. Tajfel, Lecturer in Social Psychology at Bristol Univ., has been appointed to the Chair of Psychology at Bristol University.

Dr. N. Thompson, Reader in Physics and Assistant Director of the H.H.Wills Physics Laboratory, has been appointed to a Chair at Bristol Univ.

Dr. B.G. Dickins is to be Deputy Controller of Guided Weapons at the Ministry of Aviation. He was director, Guided Weapons Research and Development at the Ministry of Supply.

Dr. Roger Penrose has received the title of Professor of Applied Mathematics at Birkbeck College, London.

Dr. Brian Donovan has received the title of Professor of Physics at Westfield College, London.

Prof. G.P. Crowden, Emeritus Professor of Applied Physiology at the Univ. of London, died on Nov. 22. He was the author of many papers dealing with muscular work, fatigue, and recovery, the effects of heat and cold with nutrition, lighting, noise, and vibration. He was appointed Reader in Industrial Physiology at the London School of Hygiene and Tropical Medicine, and later became Professor of Applied Physiology at the same School. His department was responsible for much applied research which has had effects in fields of housing, high temperature physiology, and the physiology of work.

Prof. R.M. Sievert died recently in Stockholm. He had been Director of the Institute of Radiophysics since 1937 and was an authority on the biological effects of ionizing radiation, radiation dosimetry and protection, and on natural radiation and radioactive fallout.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York 09510.

ONRL-45-66 Radar Research in the Netherlands by M.W.Long
ONRL-46-66 Psychiatry in the Norwegian Defense Forces by J.E. Rasmussen
ONRL-47-66 Notes on Psychology in Northern Ireland by J.E. Rasmussen
ONRL-48-66 Military Psychology in Norway by J.E. Rasmussen
ONRL-49-66 Technische Hochschule Aachen, Germany by J.B. Cohen
ONRL-50-66 Some Solid State Physics in the Paris Area by B.O. Seraphin

The following conference reports are releasable to European scientists:

ONRL-C-18-66 International Symposium of the Joint Services Electrical Power Sources Committee 1966 by P.D. Maycock
ONRL-C-19-66 1966 Symposium on Gallium Arsenide by P.D. Maycock
ONRL-C-20-66 Electron Microscopy in Metallurgy: A Conference Sponsored by the British Institute of Metals, Sept. 1966 by J.B. Cohen
ONRL-C-21-66 The Tenth International Conference on Low Temperature Physics (LT10) Moscow, Aug-Sept. 1966 by R.S. Allgaier (NOL Silver Spring)
ONRL-C-22-66 Sixteenth Meeting of the International Committee on Thermodynamics & Electrochemical Kinetics, Budapest by A.L.Powell (ONR Boston)

ONRL-C-23-66 The Combined Royal Aeronautical Society's Centenary Congress & the 5th Congress of the International Council of the Aeronautical Sciences by H.E. Williams

ONRL-C-24-66 Annual Meeting of the German Physical Society, Munich, 1966 by B.O. Seraphin

ONRL-C-25-66 First European Symposium on Marine Biology, Helgoland, Sept.-Oct. 1966, by J.D. Costlow

ONRL-C-26-66 International Symposium on Fluid Dynamics of Heterogeneous Multi-Phase Continuous Media, Oct. 1966, Naples, by I.Glassmann

ONRL-C-27-66 Symposium on Bionic Models of the Animal Sonar System, Frascatti, Italy, Sept-Oct. 1966 by W.J. Trott

BLANK PAGE

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) OFFICE OF NAVAL RESEARCH BRANCH OFFICE LONDON, ENGLAND	2a. REPORT SECURITY CLASSIFICATION 2b. GROUP

3. REPORT TITLE

EUROPEAN SCIENTIFIC NOTES 20-11

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
N.A.

5. AUTHOR(S) (Last name, first name, initial)

Rasmussen, J.E. and Hewitson, Victoria, ed.

6. REPORT DATE 30 November 1966	7a. TOTAL NO. OF PAGES 20	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO. N.A. b. PROJECT NO. c. N.A. d.	9a. ORIGINATOR'S REPORT NUMBER(S) ESN-20-11 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) N.A.	

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510

11. SUPPLEMENTARY NOTES N.A.	12. SPONSORING MILITARY ACTIVITY N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473

UNCLASSIFIED
Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Marine Biology Materials Sciences Chemistry Mechanics Physical Sciences Psychological Sciences						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES. Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

Security Classification

AD NUMBER: AD0804681

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 31 Oct 1966. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH
LONDON

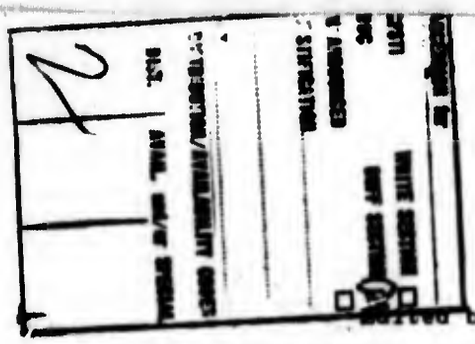
804681

EUROPEAN SCIENTIFIC NOTES

No. 20-10
31 October 1966

Distributed by the
Office of Naval Research Branch Office,
London

BLANK PAGE



OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

Edited by J.E. Rasmussen and Victoria S. Hewitson

31 October 1966 Vol. 20 No. 10

European Scientific Notes is Group II Newsletter type Class B periodical prepared & distributed by the Office of Naval Research London in accordance with NAVEXOS-P-35

(b) (6)

C.A. Froscher
Captain, U.S. Navy
Commanding Officer

REFLECTIONS OF A WANDERING LIAISON SCIENTIST

For years the liaison scientists of ONRL have written articles for ESN, occasionally tongue-in-cheek, but for the most part a straightforward and factual reporting of specific scientific information on the European scene. While some of the most distinguished scientists in the US have spent a year or more in performing liaison duties at ONRL, there has not been a vehicle to convey their general impressions of their discipline at the completion of their stay in London. The following article, which is intended to be the first of a continuing series, constitutes an effort to overcome this omission.

The articles in this series are intended to be nontechnical in nature. It is hoped they will present a perspective which extends beyond the scope of the usual technical report and that they will be of interest to all readers of ESN. There are no "guidelines" for the authors; rather, each individual is encouraged to express himself on any aspect of his professional activity in Europe which he might choose. Thus, it is anticipated that the series will be quite heterogeneous in terms of content and topic.

In order to make a series a truly meaningful and unrehearsed expression of the individual scientist's feeling or opinion, the articles undergo an absolute minimum of editing. In this regard they should be looked upon as informal expressions of the given individual's thoughts as he concludes his stay in London --not as carefully documented scientific reports.

The first paper in this series is by Prof. S. Young Tyree, Jr., who joined our staff in June 1965 as Liaison Scientist for Inorganic Chemistry. After fourteen months with ONR London, he returned to the US this past August and joined the faculty of the College of William and Mary, Williamsburg, Va., as Professor of Chemistry.

- - - - -

It has been my privilege to spend approximately 14 months visiting academic departments of chemistry throughout Western Europe. In addition, I got to the east end of the Mediterranean, visiting both Israel and Lebanon. It is my opinion, after having spent about a week in Israel and Lebanon, that this part of the Middle East might well be lumped into the "Western Europe" category. Chemistry departments were visited in Norway, Denmark and Sweden, England, Scotland, France, Belgium, Germany, Switzerland, Italy, Austria, Lebanon and Israel. Most certainly, one is entitled to reflect a little bit at the end of such a tour upon the state of chemistry in this part of the world, its relationship to European society as a whole, and its comparision with the chemical community in the United States. In what follows it must be remembered that my principal interests are inorganic and physical chemistry.

In the first instance my impression is stronger than ever that chemistry is pretty much the same no matter where one goes, nowadays. Instrumentation does not respect international boundaries, and one finds that the best instruments from various parts of the world find themselves to all other parts of the world quickly. Thus, the Atlas mass spectrometer, made in Germany, is clearly one of the most respected mass spectrometers in the world. It is widely used all over Europe. On the other hand, there seems to be an equal unanimity of choice for Varian in the way of nmr spectrometers. Without citing any more specific examples, suffice it to say that I was mildly surprised to see laboratories, from Trondheim in the north to Naples in the south, from Glasgow in the west and to Tel Aviv in the east, equipped with the same instruments that one finds in chemistry departments throughout the US. To be sure, a number of interesting specialties have evolved as chemistry has matured in slightly different environments. For example, after spending a couple of weeks visiting inorganic and physical chemists in academic institutions in Scandinavia, one cannot help but wonder if the embryonic chemist in this area of the world is not expected to learn the X-ray crystal structure technique at about the same time that he is expected to learn to ski. This remark should not be construed to infer that crystal structure determinations are the only kinds of chemistry done by inorganic and physical chemists in Scandinavia, rather it is meant to infer that the ability to do crystal structure determination among inorganic and physical chemists is about as prevalent as is the ability among the general populace of this area to ski.

A second generality (with the exception of France - more about her later) is that the language of science is English and personal contacts in the US are the rule. Without making an actual count, I would estimate that considerably more than half the departments of chemistry visited during the year had at least one member of staff who had spent a year or more in the US as a part of his professional life.

A third generality can be made with respect to the higher educational process whereby young people become professional chemists. By and large, students in European universities specialize very highly in comparison with their contemporaries in America. Regardless of the number of years required to earn the particular formal degree, which does vary widely from country to country, almost without exception the student studies chemistry for the duration of his university life, almost to the exclusion of other subjects. A very few ancillary subjects, such as physics and mathematics, are required during the first two years. The heterogeneity among curricula and degrees is enormous. Thus, I reckon it would be as difficult for a student in midstream of an English curriculum to change to a French university (over and above the language problem) as it would be for a similar American student to make the same change.

The fourth generality is difficult to articulate. It is that I am very much impressed with the number of individuals involved, and the extent of support given, for basic research in chemistry. I cannot help but wonder if the general academic scientific community is not, at the moment, living on a relatively rich diet. By diet I mean the salaries paid to professors and the funds they are given for equipment and expendable supplies. From my own point of view and with my personal background, similar to those of other scientifically trained people, it is easy to justify money spent in this way. However, a more dispassionate view discloses some research laboratories which are equipped almost to the state of opulence, completely surrounded by other segments of society that in general can only be described as being sadly neglected. To the extent that basic research is going to result in making the world a better place for the totality of society, it is possible to justify the opulence of the research laboratory to the man on the street. On the other hand, I cannot help but ask myself when is the day of reckoning going to arrive? When it does arrive, who is going to keep the score, and what will the judges' decision be? In short, I hope that public reaction will not relegate scientists to the position of second-class citizens again.

As a fifth generality and not completely unrelated to the fourth and preceding paragraph, another matter should be mentioned. Not by any means so general but in enough cases to be significant, I must admit to being a bit shocked at the attitude of the professors of chemistry in many departments toward the paths which they expect their students to chart for themselves. The attitude to which I refer is best described as follows. In the course of a leisurely conversation with a professor of chemistry in an English institution (the man has already received his FRS), I put this question: "What do most of your PhD students do when they complete their degrees?" The answer was not long in forthcoming to the effect that among all of the students he had ever had, he could remember no more than two or three who had gone into industry or government laboratory work; since, "he was happy to state," practically all of his students were sufficiently "able" to obtain university posts. Throughout much of Europe I found that professors expect to keep their best students with them as junior members of staff and research associates. Now, it is only right and proper for a professor to think highly of his best students and to think favorably of their continuing their association with him in a productive capacity for an indefinite period of time. On the other hand, there are other clear inferences to be gained in informal conversations with professors. It appears to me that they believe implicitly their best students should be recruited into the university system of the country concerned, and the less able students should be cast adrift into the "less demanding worlds" of industry and government technological and development laboratories. Furthermore, it is a widely accepted axiom that basic research, unsullied by relation to any "mission" or "practical problem," is Number One in the "pecking order."

There is always a cadre of American chemists anticipating a year abroad. The choice of department with which to affiliate is a difficult one. The large, well-established schools of chemistry with "big-name" professors are no longer

the obvious choice. To be sure, the variety of equipment to be found in the Institute of Inorganic Chemistry at Perugia is not nearly so great as in Rome. Yet, within the competence of Perugia (and many of the similar excellent, smaller chemistry departments throughout Europe) one will find one very important advantage always unobtainable in the larger departments; to wit, the interest, sympathy, and time of the professor and his senior colleagues. More often than not the professor in charge of a large department will be practically inaccessible, save for the occasional slap on the back in genuine goodwill and hospitality. He and his senior colleagues often have enormous administrative responsibilities and, as well, are away from their departments about as often as they are there. In general, I have found the quality of research and teaching done in some of the smaller, less well-known schools, to be at least equal to that which is done in the large big-name departments.

COMMENTS ON SPECIFIC COUNTRIES

FRANCE

In several ways France occupies a unique position in the Western world of chemistry. Not only at meetings and conferences in the US but also at those in Europe, outside of France itself, French chemists participate in far fewer numbers relative to their population than do chemists from the other countries of Europe. In addition, prior to my travels on the Continent, I was told by several Europeans that in almost any university chemistry department the scientists would prefer that I speak good English to poor anything else, with the exception of France. In fact, such proved to be the case. Even in the French-speaking part of Belgium, feeble attempts at French are answered, more often than not, in excellent English. On the other hand, in France the attitude appears to be the reverse. The preference is that one speaks French, even if it is very poor French, in preference to any other language. Never having been a rebel at heart, I took the advice of my European friends early on in my stay here and made a serious effort to become sufficiently fluent in the French language such that I did not have to rely on English while travelling in France. In about three weeks of visiting chemistry departments and research laboratories in various parts of France, I was told many times (with obvious pleasure) that I was the first chemistry professor from the United States that had ever visited them who was able to speak their language. I hasten to add that my daughter, who speaks French very well, having spent eight months at the University of Grenoble, living with a French family, tells me that my French is very poor. Nonetheless, in practically all of my relationships with French chemists, it was much appreciated that I was able to communicate in their language. To be sure, in one case, after laboring along for about three hours with a very able chemist, he changed without warning into English which was much more fluent than my French, with the offhand remark that "we will make more rapid progress if we speak English." Significantly, there was one and only one example of this, and the particular individual was not a native Frenchman. I am convinced that the average professor of chemistry and his junior associates have no better command of the English language than the average American professor of chemistry and his junior associates have of the French language. Thus, I find that a very real language barrier (not just "Charles' degree") separates French chemistry from the rest of chemistry. It is most unfortunate, since much first-class inorganic and physical chemistry is being done in France. In addition, I have seen with my own eyes that, as a matter of policy, the French government is investing truly enormous sums in building new faculties for the science departments in many universities. Entirely new chemistry buildings, both for instructional and research purposes, have been completed or are substantially complete at the Universities of Paris, Strasbourg, Lyon, Toulouse and Bordeaux. These new facilities are at places where I happened to visit. Other universities, where I did not happen to visit, have been given new facilities for science departments also. The new chemistry buildings which I have seen in France are very well equipped, comparable to chemistry buildings in the US in most ways.

In assessing the growth pattern and capability of academic chemistry in France, I would conclude that neither is dissimilar from that which was experienced in the US immediately after WWII. Bearing in mind the devastation which the French population found widespread in their country immediately after WWII,

it is perhaps understandable that some 10 to 15 years were required to rebuild bridges, buildings, roads, transportation systems, etc., before indulging in the luxury of new academic faculties. It is my opinion, however, that French chemistry is on the verge of arriving at post WWII maturity and that we should make every effort possible to lessen the barriers which exist between French chemistry and the rest of the Western chemical world. Individual French chemistry professors and their young associates are desirous of entering into the kind of relationship which exists between English chemistry and American chemistry, between Scandinavian chemistry and American chemistry, etc. One thing does give me pause in my plea. The working hours and eating habits of French academic chemists when they have a guest are perhaps a bit more strenuous than many of us in the States are prepared to cope with. Typically, one arrives at the chemistry building shortly after 9:00 and works until about noon, whereupon the group adjourns to a suitable restaurant for a déjeuner. A déjeuner may well consist of a six- to eight-course meal, with an appropriate wine for each course. It is certain to last until 3:00 p.m., possibly until 3:30 or 4:00, at which time the group staggers (not so much as a result of the wine, but rather from the sheer weight of the food intake) back to the laboratory and continues working until 8:00 or 8:30 p.m.

AUSTRIA-ISRAEL CONTRAST

The contrast between Austria and Israel is worth some description. To begin with a bit of orientation is in order. Austria is about the size of Maine or South Carolina, but with a population of ca. 7×10^6, is an old country, with a relatively homogeneous population. On the other hand, Israel is about the size of New Jersey, but with a population of ca. 2.2×10^6, is a new nation, heterogeneous in most aspects (except religion). In Israel, facilities and equipment for scientific research are second to none, and compare favorably with what one is accustomed to in the US. However, the comparison of the status which science enjoys in Israel with that accorded other segments of the society is downright appalling. Much housing is substandard and totally inadequate for the planned immigration program. Public transportation equipment is in unbelievably bad condition - busses, trains, and taxis. The cost of living is frightful. Most cities are dirty, Tel Aviv is downright filthy and a disgrace. The physical plant for primary and secondary education is woefully inadequate. Several individuals expressed to me the wish that the nation's well-meaning benefactors could be persuaded to channel their bequests into areas other than scientific research buildings and equipment, for the time being. To at least some of the scientists in Israel, the situation is a bit embarrassing even though they have had little control over the evolving patchwork that is Israel. (At the risk of offending Californians and Floridians, I found the oranges in Israel the best I've ever tasted.) Regardless of other aspects of the society, Israel can point with justifiable pride to a truly impressive and vigorous scientific research establishment, including buildings, equipment and scientists. Exchange, both ways, of personnel with the US is considered essential by all Israeli scientists.

The position of the scientific establishment in Austria is almost the reverse of what one finds in Israel. With three times the number of citizens as Israel and a much more settled general economy, Austria has the same number of academic departments of chemistry as Israel - five. From first-hand knowledge of three of the five, it is clear that academic chemistry enjoyes a very inferior status in Austrian society. The buildings are all very old, at least pre-WWII, some pre-WWI. Funds for equipment are meager at best. Modern instrumentation is scarce. Salaries are so ridiculous that it occurs to this wandering chemist that chicanery may be resorted to in order to enable junior academic staff to subsist. Despite such handicaps, Austrian chemists are doing some first-class work in inorganic and physical chemistry and continue to produce good young chemists. As an example, the only person in all of Europe who tells me he has been able to obtain useful spectra for a reasonable period of time with the AEI (British) nmr spectrometer is young Mairinger, an associate of Viktor Gutmann in Vienna. Admittedly, the Austrian Alps and the culture and history of Vienna are prime assets to the natives who claim that, on the average, one bed out of 18 or 19 is occupied by a tourist each night. Nevertheless, the Austrians would do well to look to the health of their scientific hierarchy, lest the same will cease to exist. The International Atomic Energy Agency, with headquarters in

Vienna, and a sizeable laboratory in Austria, may well serve as the means of awakening the country to the plight of her scientists. Thus, while association with IAEA could be an exciting and useful experience for an American scientist, it is doubtful that an association with an academic department of chemistry in Austria would prove to be so fruitful. (S.Y. Tyree)

ACOUSTICS

PTB Speech Visualizer Demonstration

Prof. Dr. M. Grützmacher, Director of the Acoustics Division, Physikalische-Technische Bundesanstalt at Braunschweig, Germany, presented a lecture demonstration "Physics of Speech Formation" at the German Institute, London, on 24 October. He demonstrated his speech visualizer (ONRL Technical Report 33-65), a formidable array of electronic equipment that worked flawlessly during his one-hour lecture.

Speech, picked up by a microphone, passes through a nonlinear distortion network, a low-pass filter, and a clipping amplifier to a differentiating network which determines the duration of the vertical sweep on a memory tube oscilloscope. The vertical frequency scale is marked off at 65, 130, 260 and 520 Hz. The horizontal time scale can be varied from 1 sec to 15 sec or more. In the demonstration lecture he used two speakers; a television camera and two television sets displayed the oscilloscope picture. The sonograph displays the fundamental and prominent harmonics (8 to 10 in some cases) as detected from axis crossing points. A separate sweep at the bottom of the picture shows signal amplitude versus time. He concluded the lecture with a short German song displayed in fundamental frequency mode.

The equipment is useful in training a deaf person to talk in a well-modulated voice instead of the usual monotone. From what I learned at the Symposium "Bionic Models of the Animal Sonar System," Frascati, Italy, 26 Sept - 2 Oct 1966, this type of instrumentation would be very useful in recording the sonar pulse produced by bats and marine animals. (W.J.Trott)

Ultrasonics for Industry 1966, Conference and Exhibition

Ultrasonics for Industry 1966, Conference and Exhibition was held in London 11-12 October at the St.Ermin's Hotel. The meeting was sponsored by "Ultrasonics," a British quarterly journal reporting the science and technology of ultrasound in industry. Exhibits displayed instruments for flaw detection, hardness testing, leak detectors, underwater sound velocity meter and machines for cleaning, welding, disintegrating biological materials, and displays of piezoceramic materials. There were two simultaneous sessions, applications and research.

G.R. Williams (Dawe Instruments, Ltd. Western Avenue, London, W 13) described the Ultrasonic Hardness Tester which consists of a diamond-tipped magnetostrictive rod which penetrates the sample 2 - 7 μ, causing the frequency of resonance to shift. This frequency shift within the range of 20 - 30 kHz, is converted to a hardness scale. The tester is calibrated for the Young's modulus of the sample. Dynamic compliance of the sample must be the same as the static compliance, and the mass of the sample plus its oil coupled support must be larger than the mass of the vibrating rod.

Philips Research Laboratories' (Netherlands) H.P. Daniels described welders for metals and plastics foils. The tip vibrates laterally for welding metals and normal to the surface for welding thermoplastics. He showed thermocouples welded to glass. Seam welding is done with a roller anvil, and the transport is produced by using an unbalancing shim mass to cause lateral and longitudinal vibration of the tip. The machine is powered with 25W.

Prof. R. Pohlman (Head of the Ultrasonics Laboratories, Rheinisch Westfalische Technische Hochschule, Aachen, Germany) discussed the influence of ultrasound on metal friction. He showed that the force to draw wire could be reduced to $\frac{1}{2}$ by vibrating the second die and tuning the length of wire between the first and second die.

Ultrasonic Aids to Blind Mobility were presented by R. Dufton (Director of Research, St. Dunstan's Home for the Blind, 191 Marylebone Rd., NW 1). He described aids developed in the UK and US. (I had heard Prof. L. Kay, Univ. of Canterbury, Christchurch, New Zealand, discuss and demonstrate the UK hand-held and head-mounted units at

the Symposium on Bionic Models of the Animal Sonar System at Frascati (Rome), Italy on 29 September.) The UK units use a charge-biased mylex condenser speaker and microphone in a 90 - 45 kHz FM sonar system, in which the audible beat signal is proportional to the distance from the reflecting object. Ten feet away it produces a 3-kHz tone. The head-mounted unit is binaural with receivers on each side of the head and seven units across the forehead to produce a 60° arc of radiation. The two receivers are directed 60° apart. The units can detect the knob on a door.

Dr. J.C. Cook (Principal Scientific Officer, Admiralty Research Laboratory, Teddington) described the ARL Bifocal 300-kHz Sonar. An article was published in "Ultrasonics" 4, p.1 (January 1966). By delineating the shadow, the recorder charts clearly showed the presence of a shipwreck, a helicopter, a 3/4-inch diam cable and clearly outlined a trawling net and shoals of fish. It is a plane array using 100-μ sec pulses, sector scan with 30° and 75 channels far range, 10° and 25 channels close range, 5° vertical beam, and has a maximum range of 700 yds.

Prof. Ian Donald (Regius Professor of Midwifery, Univ. of Glasgow) described the routine use of ultrasonic diagnosis at the Queen Mother's Hospital, Glasgow. Currently it is being used in 113 cases per month by six trained operators. The equipment uses 1.5, 2.5 and 5 mHz in the detection of pregnancy at six weeks, X-ray is useless under 16 weeks. They can measure the head size to 1 mm and detect twins at seven weeks, detect the presence of cancer, cysts, cyrosis of the liver or the need for curettage. Donald is at a loss to understand why the method is not more widely used. He has published articles in the "American Journal of Obstetrics and Gynaecology," 93, p. 935 (1965), and the "Journal of Obstetrics and Gynaecology of the British Commonwealth," 72, p. 907 (1965). (W.J. Trott)

AERONAUTICS AND SPACE SCIENCES

The Controlled-Circulation Rotor

One of the most interesting exhibits at SBAC Farnborough Air Show in September 1966 was the controlled-circulation rotor, currently under development at the National Gas Turbine Establishment, Pyestock (NGTE). This device also was discussed briefly by Prof. A.R. Collar (Bristol Univ) in his paper presented before the Centenary Congress of the Royal Aeronautical Society -- "Some Aspects of Aeronautical Research in the United Kingdom." The following account has been extracted from his paper and the NGTE Technical Information Sheet.

The aircraft industries of the world have devoted substantial effort in the last decade toward the realization of aircraft which can take off and land vertically. Such aircraft have obvious attractions and there are many potential applications in both military and civil use.

VTOL schemes can be classified according to the quantity of the ambient air they displace to generate lift and the associated downwash velocity of this air. They range from helicopters using high air quantity and low downwash velocity through convertible rotor or tilt-wing aircraft to jet lift aircraft with relatively low air demand but correspondingly high downwash velocity. Only helicopters are widely used so far. The high downwash schemes incur disadvantages of high fuel consumption and high noise level, and present some difficulty in operating from unprepared sites because of the violent scrubbing action of their high speed jets. Attention has therefore swung more and more towards large lifting rotors, varying from large dual-purpose propellers to more conventional helicopter rotors.

The major disadvantage of a large rotor propeller is that it severely restricts the forward speed of the aircraft, thereby curtailing its effectiveness in the military role and its earning capacity in the civil role; hence, the choice of jet lift for a fighter aircraft. But if a rotor could be used only for take-off and landing, being parked parallel to the line of flight or retracted and stowed away during cruise, the aircraft could fly supported on its wings alone at normal jet aircraft speeds. Unfortunately, there seems little prospect of parking a conventional aerofoil rotor in flight. Firstly, the aircraft would be unstable during the parking maneuver, because as the rotor was slowing down, any sizeable gust would produce substantial lift on the advancing blade but none on the heavily-stalled retreating blade, leading in the limit to overturning

the aircraft. Secondly, aerofoil rotor blades capable of lifting an aircraft are too large and too flexible in relation to the fuselage and wings to consider parking them in flight; and stowing them presents severe engineering problems.

In recent years, the NGTE has conducted a continuing research on the integration of lift and propulsion systems. One interesting and ingenious offshoot of this work is the controlled-circulation rotor developed by Dr. I.C. Cheeseman and his collaborators. In its initial form, the rotor consisted simply of a rigid circular cylinder. Circulation around the cylinder, and hence lift, are generated by blowing compressed air from narrow spanwise slots, appropriately positioned and directed; the rotor itself can be made to revolve either by a mechanical drive or by tip blowing -- the latter method gives no torque reaction. In the test rig, the rotor diameter is 12 ft and the cylinder diameter is 5.6 in; there are no hinges, since the lift can be controlled through control of blowing.

A rotor test vehicle has been built to supplement the RAE 24-ft tunnel in the testing of controlled circulation rotors in forward flight. Based on a standard commercial chassis, it carries the rotor at speeds up to 110 ft/sec along airfield runways. Much interesting data has been recorded from the tunnel and runway experiments: cylinder lift coefficients as high as 6 vary nearly linearly with the momentum coefficient of the air blown from the slots; wake drag coefficients (including the thrust due to the blown air) can be small or negative; the blowing cleans up the ordinary zero-lift flow around a cylinder, leaving only a small region of separation -- another form of boundary layer control designed primarily to generate lift.

Some virtues of a blown circular cylinder as a basis for a lifting rotor may be listed: 1. High C_L is achievable, requiring small cylinder diameter; 2. The cylindrical section is structurally suitable for non-articulated rotors; 3. Cyclic blowing control can, even in forward flight, make lift independent of azimuth angle. The effectiveness of the cyclic control was demonstated by the ability to trim out the pitching and rolling moments encountered without serious changes in lift or power; 4. Lift is insensitive to gusts, since the lift-incidence slope is virtually zero; 5. If forward flight is wing-borne, the blown rotor can be stopped and parked without the difficulties facing conventional rotors; 6. Rigid blades require only small clearances and little maintenance; 7. Tests of the NGTE rotor in the RAE 24-ft wind tunnel showed that the ratio of lift force to slot thrust varied only slightly (lying between about 30 and 40) with advance ratios up to about 0.5 and lift coefficients up to 5.

There is, of course, a reverse side to the coin. In order to avoid compressibility effects, the tip speed of the rotor must be kept low, and this in turn leads to high induced power. In an attempt to overcome this difficulty the NGTE has experimented with a rotor in which the section changes from a circle to an ellipse with increasing rotor radius. This means compromising some of the virtues listed above; however, most good engineering involves compromise.

Possible applications of the controlled-circulation rotor have included the study of a BAC 1-11 aircraft as a twin rotor VTOL transport. It is calculated that the aircraft is able to hover at maximum weight at an altitude of 5,000 ft at ISA plus 20°C on one Spey engine, and that including the weight penalty of the rotor installation and normal reserves, the range at full payload with vertical take-off and landing is 300 nm. (H.A. Smith)

The Combined Aeronautical Society's Centenary Congress and the Fifth Congress of the International Council of the Aeronautical Sciences

The ceremony opening this combined Congress held in London, 12-16 Sept., made the remainder of the meeting almost anticlimactic. After a series of congratulations and gifts by learned societies of many countries, the Duke of Edinburgh, Honorary President, gave a stirring opening address. He pointed out that the problem of making the right selection in research programs and development projects has become crucial to the whole of aeronautical evolution; that the time has come to make a rational assessment of the principle of applying Government support to the aviation industry. Needless to say, remarks of this type, though welcome to say the least, are certainly unexpected from a member of the royal family.

In the Daniel and Florence

Guggenheim Memorial Lecture, M.B. Morgan (Ministry of Aviation) examined the aeronautical scene in terms of the possibilities being thrown up by current research work. In the talk entitled "Some Aspects of Aircraft Evolution," he gave examples of improvements that are possible in the fields of aerodynamics, materials and engines. Such improvements as in the use of lift engines, laminar flow wings, composite materials and computer control for engine operation can mean considerable savings in over-all costs, all-up weight, and the improvement of range. He noted three problem areas which will require exceptional scientific and engineering skill, namely: (1) the design of the intakes and nozzels for supersonic flight; (2) variable geometry wings; and (3) terrain followers (in order to allow aircraft to operate safely at very low altitudes). Finally, it was pointed out that 60% of the current work load is in the further development of existing hardware, while the remaining 40% is in new projects.

Sir George Edwards (Managing Director of the British Aircraft Corporation), in his talk entitled "Anglo-French Collaboration -- the Present Position and Some Thoughts on the Future," gave some personal reflections on the general subject and made particular comments on the three current projects, Concorde, Jaguar, and Variable Geometry. After discussing the detailed contribution that Britain and France are making in the Concorde project, he noted the particular enthusiasm that is characteristic of the French contingent and the apparent success in France of the graduates of the Ecole Polytechnique. It was apparent that Sir George was indirectly commenting on the rather strained position that British engineers occupy in knowing that both the Government and the country are not wholeheartedly backing their efforts.

The remainder of the program consisted of technical papers of both survey and comprehensive nature which spanned the subject of aeronautics. Of particular importance to those in mechanics was that of Prof. A.R.Collar (Dept of Aeronautical Engineering, Bristol Univ.). His talk, "Aeronautical Research in the UK," surveyed a few topics in which the Aeronautical Research Council and he, as its Chairman, had taken an active interest over the past few years. As examples, Collar noted the work of Prof. H.C.H. Gurney (Cardiff) in crack propagation, of Prof. J.H.Argyris (Imperial Coll.) in matrix methods in structural analysis; and the controlled-circulation rotor of the National Gas Turbine Establishment. (H.E. Williams)

International Astronautics Congress, Madrid

The XVII Congress of the International Astronautical Federation (IAF) was held in Madrid, 9-15 October 1966. The host association this year was the Asociacion Española Astronautica.

The seventeen-year old IAF is a nonprofit organization with its secretariat in Paris. It's members are some thirty scientific and professional societies and organizations interested in space technology and astronautics, the principal US representative being the AIAA. The IAF numbers some of the top names in world space leadership among its past and present officers; Von Karman and Pickering (US), Sedov (USSR), Brun (France), Shepperd (UK); and its principal business, sponsoring the annual Congress, has taken it in recent years to Washington, Paris, Warsaw, Varna, Athens, and now Madrid.

Each Congress has been a highly mixed and somewhat confused potpourri of political, social and technical events, and this year's was no exception. Representatives present included the Air Minister of Spain, the Queen of Greece, an American Astronaut, several members of the Soviet Academy of Sciences, and some 1050 others from 37 Eastern and Western nations. The US sent more than 300. Spain was represented by about 265, with other large delegations coming from France, Germany, Greece and the Soviet Union. They came also from Argentina and Japan, Cuba and Bulgaria, Israel and the United Arab Republic.

There were concomitant business meetings of the IAF, the International Academy of Astronautics, the International Institute of Space Law, press briefings and 34 technical sessions, as many as five of these running simultaneously. There were also four cocktail parties, hosted by the Mayor of Madrid, the Spanish Air Minister, the Spanish Astronautical Association, and the American Ambassador, a visit to the NASA-INTA Deep Space Tracking Station at nearby Robledo, a Corrida (Bullfight) and a banquet.

The technical sessions generally

were well attended and the mechanics of the meeting were adequate. A lot of cloakroom discussions took place on a technical level - some between colleagues from different countries and more within delegations; particularly among the Americans. Bull sessions occurred at every event on the schedule ...even the bullfight.

It is fair to say that the US dominated the technical sessions. Americans gave the greatest number of papers and certainly the meatiest. The only other country capable of presenting really advanced work in space technology, the USSR, as usual released almost no technical details. An exception to this trend was in biogastronautics, in which the Soviets seemed to be willing to talk, and some good papers were delivered.

Press coverage of the Congress was extensive. Many European papers, including the Paris editions of American papers, carried daily front-page articles on the progress of the meetings. One of the favorite subjects of these reports was alleged dissension between delegations. The city newspaper, Madrid, headlined its lead article one day "The Americans, talkative, the Soviets, tight lipped," and the Herald Tribune found some Russians at cocktail parties who claimed that "the US 'monopolizes congresses' and turns them into commercial fairs with free drinks, advertising pencils, cigarette lighters, photographs and press releases." At the meeting, however, the Soviet speakers seemed friendly, eager to get US information and genuinely embarrassed by their own inability to present more information. The quality of their graphic aids was particularly poor.

There were some accusations of censorship. At least three US papers on the schedule were not given because of failure to obtain clearance at the last moment, though the authors were present. On the Soviet side, several papers could not be given since their authors "failed to arrive." The newspapers made much of these cancelled papers.

There was the usual speculation about future Soviet launches. No spectacular event coincided with the Congress this year as has frequently happened in the past. The first Sputnik was, in fact, launched during a previous Congress in Madrid in October 1957. There was talk of a 7,500,000-pound thrust booster to be demonstrated soon and a multiman space station. The week after the Congress they did orbit a Molniya and Cosmos, followed by a new lunar attempt, but these did not seem to be related to the meeting.

Most Europeans at the Congress were concerned with the possibilities for ESRO and ELDO. These seemed pitifully small and slow efforts compared with the progress being made by the two giants. A report by Val Cleaver (Chief Rocket Engineer of Rolls-Royce, UK) stated that the ELDO vehicle which will orbit in 1970 or 71 will be "five years too late."

One announcement in a technical paper on gravity-gradient stabilization of a "collision in space" received great notoriety, probably unduly. H.W. Paige (General Electric Company, USA) explained how two stabilized space-craft collided in orbit and restabilized to work successfully. Listeners and readers conjured up visions of a head on crash at 5 miles-per-second against almost incalcuable odds in all that space! Actually, the two Naval Research Laboratory satellites involved were launched together by the same booster in March 65, placed in similar velocities. Their long booms "nudged" each other in orbit. Hardly a "collision"!

Many of the US papers were rewrites and compilation of previously released material, but several of the review papers were outstanding. Worth special mention were two by Leroy Day and Kenneth Nagler (both of NASA) showing some breathtaking photographs taken during the Gemini program. Dr. Eberhardt Rechtin (JPL) presented a masterful review of deep space communications and tracking, and pointed to things to come in this field, and Harold Finger (NASA) did the same for nuclear propulsion in space.

Prof. K.Y. Kondratyev (Leningrad Univ.) chaired a session on "manned geophysical observations from satellites" and gave the survey paper in the field himself. An obviously enthusiastic and well-informed scientist, his discussion on cloud pictures and measurements of atmospheric structure by radiation scattering and absorption were followed with great interest. Yet, like most of the Soviet papers, there was a paucity of photographs and quantitative date.

The abstracts of almost all of the 300 technical papers presented were available and distributed at the Congress. The complete proceedings will

be assembled and published in about six months. Proceedings of previous Congresses are still available through the IAF Secretariat.

The Daniel and Florence Guggenheim International Astronautics Award for 1966 was made to Dr. Robert R. Gilruth, Director of the NASA Manned Spacecraft Center, Houston. Prof. L. Napolitano, Univ. of Naples was elected Chairman of the IAF for 1967, and Belgrade, Yugoslavia, was selected as the site for the Congress in the Fall of 1967. (B.I. Edelson)

MATERIALS SCIENCES

A European Materials Research Center

A proposal has been initiated by interested North European scientists to start a Materials Research Center. This would be similar in purpose to the ARPA interdisciplinary laboratories in the US, but organized similarly to CERN. Included would be work on materials preparation, structure, electronic behavior, imperfections and application. About 120 scientists, many on short-term appointments, and an auxiliary staff of 200 are contemplated. The proposed center would involve 14,000 m^2 on 35 acres and cost $12 million to build and equip, over a three- to five-year period. Annual operating costs are estimated at $6.3 million.

The Center will have an educational function as well as its responsibility to perform interdisciplinary research. The countries involved are those in Scandinavia plus Iceland and Poland; participation by Belgium and the Netherlands will be delayed as these countries feel the initial costs are too much for them. All of these smaller countries are having a considerable problem maintaining their expensive atomic energy establishments, and one gets the distinct impression that the use of equipment, facilities and staff in such locations by other groups is a possibility. In fact, it is suggested that the Center be placed near one such establishment, and it would not be at all surprising if the initial costs were reduced merely by using such a ready plant to initiate the program. (J.B. Cohen)

The Fulmer Research Institute's Open Day

The Fulmer Research Institute at Stoke Poges celebrated the completion of its new laboratory with an Open Day on 30 September 1966. A large number of guests were received by Mr. Merton, Chairman of the Institute, and Mr. E.A.G.Liddiard, Director of Research. After the guests toured the facilities, Sir Paul Chambers, Chairman of ICI, ceremoniously unlocked the doors and led a tour of the new laboratory building.

During lunch, Sir Paul noted that the Institute has shown remarkable growth in its first 20 years; income increased from £25,000 in 1946 to £2,357,000 in 1965, while staff increased from 44 to 117. He noted its exceptional stature as the first sponsored research organization wholly owned by a professional scientific institution, the Institute of Physics and the Physical Society (IPPS). The presence of Sir Paul was significant, as it was ICI which sold the Institute in 1965 to the IPPS, after ICI had acquired its parent company, Alwin, Ltd.

The new laboratory is a two-story building centered in the original laboratory complex. It houses work in corrosion, analytical chemistry and spectroscopy. Prominent in display were the AEI MS 702 Mass Spectrograph and the Siemens 125-kV Elmiskop 1A Electron Microsope.

In additon to the numerous displays related to the Institute's many activities in metallurgy and metal science, there was a display of work in fluid mechanics undertaken by the Chemical Engineering Section. An open channel about 2-ft wide and 1-ft deep has been constructed to study the hydraulic transport of solids. This complements work done in pipes in order to develop the important parameters in the movement of ore suspensions and in the removal of swarf.

Flow properties of non-Newtonian fluids have been studied and correlations developed to obtain data for pumping in larger systems.

A portable fire fighting pump on display was developed for producing thickened water by injection of a suspension of an additive. In order to illustrate its versatility, it was disclosed that the pump had recently fallen from a Land Rover moving at 30 mph!

Other laboratories open for inspection were the Physical Chemistry Laboratory, the Process Metallurgy Laboratory & Foundry, the Physical Metallurgy Laboratory, the Engineering and Mechanical Testing Laboratory, the Machine Shop,and the Physics Laboratory. (H.E. Williams)

Metallurgy at the Fulmer Research Institute

The 10th anniversary of this private research organization finds an aggressive group, headed by Mr. E.A. Liddiard, Director of Research. The Fulmer Research Instititue takes no money from its parent body and makes an annual profit of 7 - 10%. Cost accounting is done monthly. Proposals are thought through, but little or no work is done in most cases until contracts are received, so that only about 2½% of the contract charges constitute prior effort. The group is very conscious of patents, and if the project is sufficiently interesting, they will do enough preliminary ground work to obtain one in order to offer it to the program sponsors. Jobs can be long-range projects or short-term "quick and dirty" tests. A survey revealed that if they had a mass-spectrometer enough companies would send a few samples a year to them to pay for the instrument and its operation; so they are just installing one - not for any profit on this particular operation, but with the hope that when these firms visit with their small jobs, they will find other features of the laboratory useful.

Dr. John Coiley, formerly at Aeon Laboratories (another laboratory similar to Fulmer) heads metallurgy. There are three electron microscopes in use, including a new 125-kV Siemens, complete with a curved crystal microprobe attachment that they are helping to develop. The feeling here is that they prefer this combined instrument to a microprobe, per se, because of the better resolution of the microscope (100 Å). At the same time it is a third scope. They are also of the opinion that a high-voltage microscope is not sufficiently more useful over this combined instrument to justify spending the money for it.

Dr. G.J. Williams runs an X-ray section, which interacts strongly with many of the other groups - not only on a service basis but also with long-range projects. This group is perhaps best known for its work on liquid metals and alloys. The X-ray unit used for this employs a large flat horizontal liquid surface, and the X-ray tube and counter are moved manually to vary 2 θ. The liquid level is kept constant by measuring its position relative to a rigid knife edge with an optical microscope. The radiation is monochromated with a bent quartz crystal. The initial alignment, to make the incident and diffracted angles equal, is done with the aid of a quartz single crystal floating on the liquid. Absolute measurements are obtained by matching the high angle data to the calculated scattering for independent atoms - in the usual way. This match is adjusted to eliminate oscillations at small distances in the radial distribution curve.

With Sn, Au, Cu-Sn, and Au-Al, a shoulder has been found on the high angle side of the main peak. The intensity of this shoulder varies with composition, and in some cases, e.g., Cu_3Sn, there is just one sharp peak at at its position. The interatomic distance corresponding to this peak is found by transforming the difference between the actual pattern and one obtained by extrapolation under this ledge or shoulder. Because this ledge seems to be present in all alloys of a binary, the group feels it corresponds to some interatomic distance present in liquids of all compositions.

The group has just recently found such a shoulder in liquid Hg, by comparing its pattern to the more symmetric pattern for, say, gold. It appears to correspond to a distance in the low temperature or high pressure polymorph. Other properties of these liquids are also being studied.

Some of the results on Cu-Sn alloys are being used at Harwell, along with neutron diffraction studies of alloys made with two Cu isotopes, to do an anlysis for AA, BB and AB pair densities.

Another X-ray unit has been adopted to study grain growth at high temperatures, using Warren's analysis of the scatter in intensity with sample position to yield grain size. An external heat lamp is used for heating, and the specimen is in a vacuum of 1×10^{-7} mm of Hg. The sample's position is changed with a magnet. The X-ray windows are 1.5-mils thick and made of an Al-Si alloy sealed to the glass vacuum system with a glass-to-metal seal. With about 1½% Si, work-hardening during rolling is sufficient to allow easy handling of these thin windows.

The Warren technique has been checked against metallographic results with an equi-axed Cu-Sn alloy, and the agreement is within 10%.

To study phases that develop rapidly in U-Mo alloys, a very small Debye-Scherer camera is being used in conjunction with a rotating anode

X-ray source.

One quite ambitious study is under way. They are setting up to measure short-range order in a Ag-Zn alloy, for A. Le Claire at Harwell, so that he can test a new theory (involving these parameters and Cowley's theory) on the anisotropy of the internal friction peak due to solute redistribution.

There is an excellent group with years of experience and data studying Al-base alloys. A ten-year testing project is just being completed on a proprietary Al-Cu-Cd alloy, which eliminates the exfoliation problem.

Much of the work on the effects of trace elements in Al on precipitation is well known. Particularly interesting to me was the fact that with some trace elements, precipitate formation after quenching can be delayed for many months. Here, again, is evidence of some particular configuration required for a precipitate, not just excess vacancies to enhance the kinetics.

Dr. P. Gross is continuing his studies of thermodynamics of alloys, particularly these days using halide reactions. He has also used these compounds to deposit superconducting compounds and W.

A new group in a new building is much involved in studies of stress corrosion and hydrogen embrittlement, particularly to determine their relative roles in slow deformation in a corrosive environment. A potentiostat is being employed, which will alter the anodic potential and hence affect stress corrosion - but not hydrogen embrittlement. Poole who heads a "process metallurgy" section has been involved in developing a floating-zone device for growing crystals of Al_2O_3, using an electron beam for heating. It is in operation and producing crystals. A scanning electron beam has been used as well to purify alumina.

In the same group they have been trying to find out why certain cast irons have better heat transfer in engines than others, and why machining off a relatively large thickness can help some of the poorer products. They find that nucleate boiling is enhanced by graphite flakes that stand out in relief from the surface, after some corrosion takes place. Thus cast irons with well-developed flakes are better as heat transfer media. (J.B. Cohen)

MATHEMATICAL SCIENCES

MOT Accelerates Advanced Computer Technology Program

Mr. F.J.M. Laver (Head, Computer Division, Ministry of Technology) described a "forward leap" program in advanced computer technology supported by the Ministry of Technology (MOT). Several million pounds have been awarded to British electronics firms in order to accelerate the development of computer technology in the UK.

Since the general election in October 1964, the Labour Government has implemented its plans for reorganization of the administration of education, science and technology. With the passing of the Science & Technology Act, 1965, the Department of Scientific and Industrial Research (DSIR) disappeared, and the responsibility for government-sponsored industrial research was divided between the Ministry of Technology and the Department of Education and Science.

The MOT is headed by A. Wedgwood Benn, M.P. The five Divisions responsible for government support of R&D are: Computers - F.J.M. Laver; Telecommunications & Electronic Science - A.M. Houghton; Machine Tools - R. Bullock; Mechanical Engineering - C. Coffin; and Electrical & Chemical Plants - A.C. Capisarow.

The Advanced Computer Technology Program, headed by Laver, supports both research and applied projects. The Program is managed by the Advisory Committee, which meets three times a year at the site of one of the contractors. One half-day is spent reviewing the progress of all contractors and the other half is spent reviewing the progress of the host contractor. The Advisory Committee comprises several civil service professionals, two or three representatives of each of the industrial contractors, and several university members. Progress reports are made to the MOT and are treated as "Commercial in Confidence." They are not released outside Government. Patent protection is afforded the contractor precisely as in the DoD. Most contracts are of the 50/50 cost-sharing type.

The selection of contractors, determination of funding, etc., are performed by an Executive Committee, also headed by Laver, which is divided in two sections, Software and Hardware. Members are all government scientists. They identify weak areas, solicit proposals, and proceed to fund the R&D.

Contracts awarded in the past four months total several million pounds. The table below shows the recipients, funding, and subjects covered. One contract not listed is for £2 million to Elliott Brothers for R&D on applications of computers to process control. Automated paper production will be a major subtask. (P.D. Maycock)

RECENT CONTRACT AWARDS BY MOT

Contractor (No. of Contracts)	Total Value*	Subjects
International Computers & Tabulators, Ltd. (7)	£392,500	high speed logic, design automation, optical store, fluid logic, optical character recognition, integrated circuit interconnections.
Plessey, Ltd. (4)	129,100	pattern recognition, plated wire store, high speed plated wire memory, production control soft ware.
Ferranti, Ltd. (3)	127,000	integrated circuits, bipolar transistor store, circuit integration, and interconnection.
Mullard, Ltd. (2)	186,000	MOST store, character recognition
Standard Telephones & Cables Ltd. (2)	108,600	speech recognition, dependability of digital systems
Elliott Bros., Ltd. (1)	75,000	tunnel diode logic
Associated Electrical Industries, Ltd. (1)	66,000	GaAs tunnel diodes
Bedford Computer Svcs, Ltd. (1)	60,000	production control
British Telecommunications Research, Ltd. (1)	52,000	fluid logic

*(£1 = $2.80)

MISCELLANEOUS

John Dalton's Birthday Party

"Matter is corpuscular, and the indivisible particles of its elementary substances have a definite mass and combine with one another in simple integral ratios." So said the Manchester schoolmaster, John Dalton, in 1803. His atomic theory laid the basis for the remarkable development of chemistry during the nineteenth century, and -- despite the fact that atoms are not after all the ultimate and primitive stuff of the universe that he envisaged -- his concept stands as one of the most durable and fruitful in the whole fabric of science.

The bicentenary of Dalton's birth was celebrated at Manchester during the week of 19 September in a program of ceremonies sponsored by the Royal Society, the Manchester Literary and Philosophical Society, the Chemical Society, the Royal Institute of Chemistry, and the Society of Chemical Industry. Representatives of the principal learned societies of Europe and America were on hand to join with the local community in the proceedings -- symposia, invited lectures, evening receptions, and the conferring of awards and honorary degrees -- all of which were carried off with faultless style and polish.

The theme of the meeting was provided by a series of papers and discussions by historians of science dealing with Dalton's life and times, tracing the background and evolution of his contributions in chemistry, meteorology, and the study of color-blindness. These symposia, while decidedly the work of specialists insofar as any scholarly give-and-take was concerned, could nevertheless be understood and enjoyed by all of the assembled company, few of whom were historians even by way of avocation. For this happy choice of subject matter, the organizers are to be commended.

The Victoria University of Manchester conferred three honorary degrees. Prof. H.C. Urey of the Univ. of California (Santa Barbara) was cited

for contributions to science -- especially the isolation of deuterium -- having special pertinence to the extension and development of atomic theory. Prof. H. Butterfield of Cambridge was honored as an outstanding historian and interpreter of science. And Prof. Michael Polanyi of the Manchester faculty was recognized as a rare universalist who, having achieved eminence as a scientist, was able to bridge the gap between Snow's two cultures and pursue a second distinguished career in economic and social studies.

The Dalton Medal of the Manchester Literary and Philosophical Society was awarded to Sir Cyril Hinshelwood. His acceptance speech, like a companion lecture of Polanyi's, dealt with some aspects of the nature of reality -- or What Is Truth? I do not believe that this matter was settled during the symposium; we will have to make do a while longer with the pragmatic definition that truth is any consistent body of ideas that fits observable facts. A less cosmic sidelight in connection with the matter of reality is that as recently as the first decade of the present century, the literal existence of Dalton's atoms was by no means universally accepted. Notwithstanding the success of the atomic theory in unifying chemical phenomena, such reputable scientists as Ostwald and Kahlenberg were unbelievers, and it remained for J.B. Perrin to dispel all reasonable doubts through his experiments on Brownian motion. His son, Prof. F. Perrin, was the delegate from l'Institut de France at the celebrations; as high commissioner of the French nuclear energy authority, he is convinced -- quite apart from filial loyalty -- that atoms are indeed real.

The finale of the celebrations was the annual Dalton lecture, delivered this year by Prof. R.H.Nyholm of University College, London. I suspect that this may have been a more climactic event than was really intended by the organizers. The title, "Atoms and Energy in Modern Science," turned out to be something of a misnomer. After a perfunctory bow to John Dalton, Nyholm launched into a rousing indictment of the British educational and cultural tradition and of the policies and attitudes which have shaped it. In essence, his speech was a plea--more accurately, a warning -- to teachers and administrators to "drag Britain, kicking and screaming, into the twentieth century." Unless this is done soon, he says, the country is done for as a significant force in the modern world, and no comfortable recountings of past glories or reliance on muddling through will save the situation. The main ingredients in his own prescription for salvation comprise a broader grounding in general scientific knowledge for the educated public at large, even if this means that future business and civic leaders cannot read Greek classics in the original; more emphasis on the training in technology and engineering as opposed to "pure" science, and the elimination of the stultifying image of the applied sciences as rude mechanic arts unsuited as occupations for gentlemen; more effective use of scientists and engineers by industry, and more aggressiveness and enterprise by management in exploiting new science and developing new technology; and finally, harder work by university students, which he thinks needs to be exacted primarily by their teachers but reinforced where necessary by requiring the students to pay a greater fraction of their educational expenses from their own pockets.

I am sure that these sentiments have been uttered before, but I doubt whether they have been stated with greater force, or in blunter language, or to an audience which expected an hour's bland entertainment in popular science. Reaction was predictably mixed. But then every party has an unconventional guest, and John Dalton's was no exception. That's the way it should be. Gingers things up! (J.A. Bierlein)

Building Research - An Open Day

The Building Research Station, Watford, England, established in 1921, was the first organization of its type. Responsibility for the Station, previously with the Department of Scientific and Industrial Research (DSIR), moved to the Ministry of Technology in 1965. Policy is formulated by a Steering Committee directly responsible to the Ministry and chaired by Dr. E. Lee, Deputy Comptroller (MOT). It includes Dr. J.C. Weston, the new Director of the Station, and Sir Robert Wynne-Edwards, Chairman of the much broader-based Advisory Committee on Building Research which has representation from all branches of the industry.

The Station, pleasantly situated on some 70 acres, held its third

series of Open Days between the 19th and 27th of September. The first and second series of Open Days, held in 1961 and 1964, attracted some 3,000 and 6,000 invitees, respectively. For the current series, 12,000 were expected, and it had been necessary to extend the program into a second week. Sir Robert, opening the private view on the 19th, emphasized the continuing broadening of the Station's interests, which over the years had grown from building materials through structural engineering, soil mechanics, the physical environment within buildings, e.g., noise, heat, building methods, user needs, and most recently, the study of building operator skills. Throughout the years, in fact, it had continued to maintain a broader program than any comparable station, although somewhat similar stations have been established in almost all developed countries. Commenting on the growth of the Station - it now employs about 700 with a growth rate of 4% per annum - he pointed out that its funding represented less than 1/10th of a penny per pound sterling of the industry's turn-over (1 part in 2,400), and called for a greater growth rate.

To meet the diverse needs and interests of the wide range of invited guests, politicians, union leaders, building contractors, scientists, engineers, architects, etc., the Station utilized a wide range of techniques including films, lectures, working demonstrations and displays in presenting its program, covering environmental design, structural design, materials and components, production, and its information and advisory service. Indicative of the broad scope of scientific and technical disciplines involved at the Station were the following from among some 50 displays: (1) Sound transmission through partitions using the large adjacent anechoic reverberant chambers; (2) wind tunnel investigations concerning air movement around large buildings; (3) the study of building operative skills aimed at providing a basis for a review of training methods; (4) instrumentation for measurement of the deflection in underground tunnel systems; (5) structural testing; (6) corrosion protection of steel in concrete; and (7) work on fiber-reinforced cement products employing glass fibers resistant to alkalis. Historically, the Station has produced numerous specialized publications to carry its results to industry, supplemented by its information advisory services, "Open Days," etc. There is little doubt, however, that along with further emphasis on the applied side in line with increasing recognition of the many practical problems faced by the building industry, additional consideration will be given to the methods of carrying the Station's research to industry. Among other items appropriate post-graduate courses will be offered next year at the Station. In many ways, the Station and its relationship with the industry it serves, which accounts for approximately 1/8th gross national product, is typical of the whole problem of the relation of research and industry in the UK which the Ministry of Technology must face. (A.W.Pryce)

OCEAN SCIENCE AND TECHNOLOGY

Irish Scientists and the Irish Sea

Within the past few weeks two separate meetings were held in the interest of evaluating the present state of marine biology in Ireland and to consider the present efforts directed toward the scientific exploration of the Irish Sea by individuals from a variety of disciplines and institutions.

The review of marine biology in Ireland took place 15-16 September at the Queen's University, Belfast. Representatives from a number of universities and fisheries in Northern Ireland and Eire were present, including those from Queen's University, Belfast; University College, Dublin; Trinity College, Dublin; University College, Galway; University College, Cork; Magee University College, Londonderry; Ministry of Agriculture and Fisheries, Belfast; and Department of Agriculture and Fisheries, Dublin.

As may be anticipated at conferences of this nature, the view was presented that the state of the science has reached a point at which a general discussion of future developments would be appropriate and helpful. Further, there was complete agreement on the need for providing some means for closer communication and cooperation in the future. The possibilities for initiating a formal organization, i.e., Irish Marine Biological Association, were considered, but it was felt that at the present time a less formal organization could accomplish the desired goals. Informal meetings of an Irish Marine Sciences Convention

were agreed upon similar to those adopted by workers in freshwater fisheries, and Dr. Went (Dept. of Agriculture and Fisheries, Dublin) agreed to act as the convener for the first of these meetings which will be held in Dublin, 25 February 1967.

In the discussion of the existing facilities and the need for additional laboratories there was general concern that future developments might result in the establishment of many small field stations, none sufficiently large to be competitive in the international field. This led to the following conclusions: (1) it is not practicable to combine fisheries laboratories and marine biological laboratories. They differ in their aims and in their work, and this should be made clear to the authorities by the analogy of existing institutions elsewhere; (2) there are two general types of marine biological establishments, (a) field stations, usually small buildings used for portions of the year and without permanent staff, having a useful function in the provision of undergraduate courses, and (b) marine biological laboratories, larger more fully-equipped buildings in full-time use and with their own scientific staff, offering good facilities both for research workers and for student courses; and (3) future developments should aim at providing two large marine biological laboratories in Ireland, one on the east coast and the other on the west. An expansion of the existing facilities at Portaferry and at Carna could fulfill this purpose. It was recommended that a joint letter from the representatives attending this meeting be prepared, setting forth these views. The letter would be sent to appropriate university and government authorities in Eire and Northern Ireland.

Various possibilities concerning closer cooperation in teaching marine biology were considered. Special emphasis was given to joint courses in specialized marine topics at the senior undergraduate or "post-graduate" level, perhaps following the successful pattern established by the Nordic Council (see ESN 19-5, 79). This would involve the cooperation of staff from the various Irish universities as well as provide for the use of outside specialists in the various fields. It was agreed that this would require rather careful planning to coincide with established programs within the universities.

The proposal to exchange students and staff for the various undergraduate courses in marine biology was enthusiastically received. Other possible ways of cooperation include the pooling of funds to enable visiting lecturers to be brought to Ireland to deliver lectures, the circulation of conference reports, and the offer by the Zoological Station, Naples, of unused table space to be used by other institutions.

To facilitate the exchange of data, it was suggested that a common system of keeping fauna records might be desirable. Professor O'Ceidigh (University College, Galway) and Dr. Boaden (Queen's Univ., Belfast) agreed to draw up a scheme for further consideration.

The second meeting was held on 25 Sept. 1966 at the Marine Biological Station, Port Erin, Isle of Man, following the regularly scheduled meeting of the Challenger Society. A considerable number of institutions are at present working on biological, chemical, physical, or geological problems in the Irish Sea or are planning such work. It has been suggested that an improved exchange of information on programs in this area might result in more effective cooperation between different laboratories and avoid wasteful duplication of sampling.

Existing programs in the Irish Sea were briefly summarized as follows: Marine Biological Station, Port Erin, Isle of Man: Chemical hydrography has been concentrated in a region near Port Erin on a transect across the Irish Sea along 54°N. Studies on plankton distribution, migrations of herring, and on the scallop fishery have been confined to the region within about 25 miles south of Isle of Man. Other work has included studies on burrowing amphipods in the littoral and shallow water around the Isle of Man and, to a lesser extent, in the sandy areas around the periphery of the Irish Sea and investigations by diving of bottom fauna and algae in the sub-littoral zone south of the Isle of Man. A new research vessel should be in operation in 1967, and numbers of both staff and research students are expected to increase. Extensions of the hydrographical and plankton surveys into St. George's channel are planned, and the herring

investigations will be extended further beyond the Isle of Man.

Marine Science Laboratory, Menai Bridge: Surveys of chemical hydrography, phytoplankton and zooplankton, and benthos have been concentrated in an area within 10 - 12 miles of Anglesey to the north, 20 miles to the west, and south to the north end of Cardigan Bay, including the release of current drifters in the same general area. Studies on the acoustic and other properties of sediments of the Irish Sea have been in cooperation with departments at the Universities of Durham and Birmingham. The new vessel, expected to be operational in 1967, will increase the frequency of plankton surveys (with high-speed nets) and the benthic surveys will gradually be extended southwards to cover all of St. George's Channel. This will include detailed productivity studies in Caernarvan Bay or Tremadoc Bay and direct measurements of currents at different depths.

Queen's University, Belfast: Research at the Portaferry field station is limited to Strangford Loch and up to six miles offshore. At the present time it is restricted to studies on interstitial fauna, crabs, scallops, and parasitic copepods. Plans are underway for a permanent staff and an extension of the facilities at the field station.

Fisheries Division, Dublin: Present investigations include those on whiting, plaice, nephrops, and, to a lesser extent, sand-eels and sprats. Two ships are working, largely in the Irish Sea, and space is frequently available on these ships for visiting scientists.

Fisheries Experimental Station, Conway: The laboratory has a general interest in all shell fisheries (molluscan and crustacean) on the English and Welsh coasts. These include projects to survey scallop beds off west Wales, distribution of nephrops between the Isle of Man and Cumberland, supervision of industrial pollution off Cumberland, and the rearing studies at Conway on several species of marine invertebrates.

University College, Swansea: Present efforts are limited to a survey of fauna and algae, largely restricted to the north coast of Bristol Channel to Pembrokeshire Islands. It is expected that a hydrographic oceanographer will be appointed to the staff.

University College, Aberystwyth: Largely in collaboration with the group at Menai Bridge, studies are being continued on the hydrography and geology of Cardigan Bay.

Department of Oceanography, Liverpool: Research includes studies on currents of Liverpool Bay, mixing and turbulence off Anglesey, and current measurements from induced electric currents in submarine cables. Direct measurements of water currents in these areas are necessary for calibration. Individuals within the Civil Engineering Department are working on sediment transport in Liverpool Bay, and members of the geology staff are interested in the floor of the Irish Sea.

Lancs. and West Seafisheries, Preston: This group is interested largely in the area from Solway to south of Cardigan Bay. A new laboratory has recently been completed, a marine biologist appointed to the staff, and one ship is available. Future studies will involve the effects of sewage and industrial effluent, especially in estuaries and surveys of littoral flora and fauna before and during discharge of effluents.

Fisheries Laboratory, Lowestoft: Interest in flatfish rearing continues concomitant with studies of existing stocks and recruitment of plaice, especially east of the Isle of Man. Nutrients of the area, including horizontal and vertical distribution, are being studied in addition to the use of anchored stations and bottom and surface drifters to obtain data on water movements. They are also involved in regular monitoring for radioactivity in the Irish Sea.

Department of Geology, Birmingham: The studies of this group include gravimetric, magnetic, and seismic surveys of St. George's Channel (with Cardigan Bay) from chartered vessels, extending south of Ireland.

Department of Geology, Durham: A seabottom gravity survey of the north Irish Sea from chartered vessels is nearing completion.

Department of Geodesy & Geophysics, Cambridge: Efforts within this Department are restricted to studies on the geological structure to the edge of the continental shelf, largely to the north and south of Ireland. It was suggested that the R/V John Murray was not being used to capacity during the winter months.

University College, Dublin: At the present time surveys of planktonic copepods and amphipods are being continued.

Tidal Inst., Birkenhead: The studies

are primarily concerned with separation of tidal and non-tidal variations in level and currents, but there is considerable interest in all forms of current measurement.

Dale Fort Field Centre: Studies largely coastal, including effects of industrialization on coastal waters.

Admiralty, Hydrographic Department: Occasional surveys of depth, gravity, and magnetism.

In the discussion which followed the resumés, it was agreed that biologists, hydrographers, and geologists should be better informed of each other's activities and of plans in the Irish Sea and that there should be some machinery for periodical exchanges of views between the various disciplines. It was asked that these views be conveyed to the committees of the National Environment Research Council and the Challenger Society and that the latter consider the suggestion that half a day of most regular society meetings should be set aside for informal discussions on programs and projects in the general area of the host laboratory.

It was suggested that a colloquium on the biology and hydrography of the Irish Sea should be arranged to take place in Birmingham in December 1967 at the time of the geological symposium now being arranged and that the British National Committee on Oceanic Research (within the Royal Society) should be asked if they would be interested in organizing such a meeting.

Attention was drawn to the recent formation of the Irish Marine Sciences Convention, whose first annual meeting will be held in Dublin, 25 February 1967.

This author is not the first American scientist to visit Ireland to view developments in the marine sciences. Previous reports (ESN 19-10, 166) have reviewed the potential for the development of marine biology, fisheries, and oceanography there. The laboratory which was considered for the West Coast over five years ago is still only a subject of discussion, and within the university circles, the continued delay is attributed solely to the reluctance of the fisheries biologists to leave the cosmopolitan comforts of Dublin for the rural beauty of the Galway coast. Thus, while the two recent meetings could represent a significant effort toward the development of these disciplines in Ireland, it remains to be seen whether they represent a positive step or just another discussion in a prolonged delaying action.

Scientific research within the Irish Sea may be visualized as a miniature replication of the numerous marine biological-oceanographic ventures throughout the world. Successful efforts toward cooperative planning, joint utilization of facilities, and improved means of exchange of information at the level of the individual researcher should certainly be a major contribution toward the scientific exploration of the Irish Sea and, conceivably, provide a working model of an interdisciplinary approach which other larger groups could profitably emulate. (J.D.Costlow, Jr.)

Marine Biology - International Journal on Life in Oceans and Coastal Waters

At the recent First European Symposium on Marine Biology, Helgoland, Germany, Prof. Otto Kinne, Director of the Biologische Anstalt Helgoland and host for the Symposium, commented on the fact that the gap due to the absence of an international journal devoted to the study of life in oceans and coastal waters will soon be filled. Kinne has been invited by Springer-Verlag (Berlin, Heidelberg, New York) to organize such a new journal. He will meet with their representatives in the near future to consider the details, and hopes to have the first issue out sometime in 1967.

As Kinne views the new journal, its scope will include marine zoology (including fisheries biology), marine botany, and marine microbiology (bacteria, fungi, blue-green algae). Papers on physical, chemical, or geological oceanography will only be included if they are immediately pertinent to marine biological problems. The view was expressed that purely taxonomic studies would be better included in journals primarily devoted to systematics. Articles in English, French, and German will be considered for publication and, assuming that the technicalities can be overcome, manuscripts in Russian will also be welcomed.

In considering marine zoology and marine microbiology, the following aspects seem to be of particular interest:

(a) Ecological dynamics: Production, transformation and decomposition of organic matter; food chains; energy flow and balance; population dynamics; ecosystems; biological oceanography; organic resources of the sea; water

pollution problems.
(b) Experimental ecology and physiology: modifying effects of environmental factors upon tolerances, rates of metabolism and activity, reproduction and other functions, as well as on external and internal structures. Mechanisms of regulation (e.g., volume-, ion-, osmo-, turgor-regulations) and adaptation (genetic and non-genetic).
(c) Distributions, zonations, communities, etc.
(d) Cultivation, life histories and diseases of ocean and coastal water living organisms.
(e) Biochemistry, genetics and evolution
(f) Methods and apparatuses employed in marine biological studies.

Kinne expressed high hope that through the composition of the Board of Editors and Advisors, a high professional standard and truly international character may be initiated and maintained. The editors will be fully responsible for manuscripts accepted and edited by them. Each editor shall, in agreement with the editor-in-chief, select one to four members of the Board of Advisors. This Board, composed of perhaps some 30 individuals chosen to represent adequately the various scientific fields covered by the journal, will be consulted by the editors regarding the scientific merit of the manuscripts submitted.

In replying to the comment, "Oh no, not another journal," Kinne pointed out the two major factors which have convinced him of the genuine need for a journal such as is contemplated. First, his present efforts in organizing Marine Biology (a comprehensive, integrated multi-book treatise on life in oceans and coastal waters) have presented him with numerous inquiries concerning such a journal. Secondly, a study of marine biological journals presently published has revealed that there exists a total of 45 such journals; 40 of these are "station journals," issuing publications of individual marine laboratories; three are review journals; and two are regional or national in character.

Kinne, as editor-in-chief, stresses his intention to pass along the responsibility for the journal, as well as the contents thereof, to the individual editors. In this way he hopes to avoid the charge, heard from time-to-time, that editorial boards are composed more for prestige than for productivity. It is to be hoped that he succeeds in achieving prestige in fact as well as in name. (J.D. Costlow)

PHYSICAL SCIENCES

Microwave Spectroscopy in Bangor

Prof. John Sheridan is well known for his research on microwave spectroscopy of gases (Annual Rpts of the Chemical Society 1963, 60, 160). He first became active in millimeter wave spectroscopy during the late 1940's while serving on the staff of the Physics Department, Duke University, under Prof. Walter Gordy. After returning to England, he was for some years a Senior Lecturer in Chemistry at the University of Birmingham. Two years ago he became the Professor of Physical and Inorganic Chemistry at University College of North Wales in Bangor.

Univ. College of North Wales received its Royal Charter in 1885. It is located on a magnificent site on the ridge to the north of the valley in which the old town and the cathedral lie. Bangor was the site of the Celtic religious and learned community, founded perhaps in the sixth century. Archaeological evidence of the remote past still exists in the College park.

Since the end of WWII, the rate of expansion in Bangor, as elsewhere, has been far greater than in any previous period. Student members have increased from 500 in 1946 to 2000 in 1966; the academic staff, including 33 professors, numbers 235. All science departments have acquired extensions and new buildings; the Chemistry Department is located in a new six-to-eight story building of modern architecture.

At Bangor, 60 students receive undergraduate degrees in chemistry each year, and there are about 20 chemistry graduate students. Sheridan says that most of this efforts in Bangor have been directed toward building up instrumentation and personnel for a strong group in spectroscopy. Dr. Peter Curnuck, also a chemist, accompanied Sheridan from the University of Birmingham and is a key assistant for the experimental program.

Sheridan bubbles with excitement over the promises to spectroscopy o offered by our advancing technology. He is planning experiments on hyperfine structure that require sources which are highly stabilized, dreaming of measurements on previously unreported molecules with instrumentation having excellent amplitude sensitivity, and planning to have available instrumen-

tation for covering all frequencies from microwaves through infrared. The availability of on-campus computer services at Bangor is also exciting to Sheridan. He says that the productivity on computing molecular structures is so vastly improved by computers that his whole outlook has been changed on the classes of molecules that can now be analyzed through spectroscopy. Above all, Sheridan is working toward the availability of instrumentation with which the inexperienced chemistry graduate student can reliably obtain "state of the art" spectroscopic data.

Most of the current spectroscopy is done in the frequency range of 8-40 Gc, but Sheridan plans to completely overlap the gap between microwaves and infrared through use of the best available millimeter and submillimeter wave techniques. In addition, a new Perkin-Elmer Type-225 spectrometer is being used which permits infrared measurements to be made for wave-lengths as long as 0.05mm. Infrared data are being used in combination with microwave data to study effects of interference in the rotational lines caused by various vibrational states.

Spectroscopists desire to span the gap between microwaves and infrared because of the common and exasperating experience that "the all important" line always seems to fall outside the available coverage of one's instrumentation. If good millimeter and submillimeter data were available, more could be learned about molecules previously studied with microwaves. For example, studies of centrifugal distortion, in general, require data from rotational transitions that are widely separated in frequency. The availability of a wide frequency coverage can, in effect, also serve as an isotopic separator. For example, rotational lines for the various isotopic species of a molecule are separated more for the high rotational transitions than for the low ones. Small detailed effects are often far more pronounced in one region of the spectrum than they are in another. It is sometimes of interest to study effects of nuclear quadrupole splitting at the lower rotational transitions of a molecule, but it may also be desirable to subdue these effects; this can be done by studying the high rotational transitions that often are at millimeter or submillimeter wavelengths.

For some years Sheridan's millimeter and millimeter wave research has been partly supported by US Air Force grants. While wavelengths near 1 mm have been used by a few microwave laboratories (Phys. Rev. 135A, A295, July 1964), the techniques have been largely empirical and have been sufficiently erratic to prevent their wide adoption. To obtain short-wavelength radiation, Sheridan and others have generated harmonics of a fundamental frequency in a point-contact diode, and another diode is also generally used for detection. Spectroscopists usually use driving powers of approximately 100 mW obtained from a klystron operating in the 1-cm wavelength region. Although the spectroscopy, per se, does not require much power, the high power is required for good efficiency in generating harmonics. Unfortunately, diodes are sensitive to burn-out and degradation in performance at these power levels. Also, millimeter-wave diodes with point-contact geometry have extremely small dimensions and fabrication is difficult to control (Proc. IEEE 54, 575,(1966)). Because of these difficulties, Sheridan previously directed a good bit of effort toward the fabrication of diodes in order to obtain better and more consistent control of the generation and detection of harmonics.

In spite of the problems with harmonic generation, it has the advantage that expensive and generally unavailable sources of power at very short wavelengths are not required. Another advantage is that for a relatively small tuning range at the fundamental frequency, a very wide and continuous band of frequencies is accessible. This is so because a reasonably small tuning range at the fundamental source frequency can be sufficient to sweep one harmonic into the band swept by the next.

Sheridan has apparently abandoned further attempts to scale down the size of harmonic generators in his effort to cover the submillimeter region. He is now developing a system based on the Froome-type harmonic generator that consists of a metal-plasma junction. Harmonics at over 1000 Gc have already been detected with such a device (Jnl.Sci.Instr. 40,225 (1963)). Sheridan plans to drive the generator with either a 4-mm or 2-mm Carcinotron that will be frequency stabilized.

A Froome-type harmonic generator is being fabricated in Bangor in accordance with designs obtained from Dr. P.H. Knapp of Queen Mary College,

London. Knapp has used such a generator in conjunction with a 10 to 20-w klystron, and has found evidence that considerably more power could be usefully employed. When using a Golay cell detector, a signal-to-noise ratio of about 10 has been obtained for the 20th harmonic (0.43-mm wavelength) at Queen Mary College (Proc. IEEE 54, 528, 1966).

At conventional microwave frequencies, a substantial effort is being directed toward the study of relatively complex planar molecules. Sheridan says that these molecules are a dream to work with experimentally, because their large electric dipole moments cause the absorption lines to be very strong. The molecules produce many lines, but they are easy to analyse now that substantial computer time is available locally. According to Sheridan, asymmetric rotors that require calculations so complex that they would have never been considered prior to the advent of computers are now being handled on a routine basis. (M.W.Long)

Commercially Available Submillimeter Wave Spectrometers

Interference spectroscopy, or Fourier transformation spectroscopy, is a modern infrared detection technique that is becoming widely used in the submillimeter region. In this technique the radiation from an incoherent source is divided between two beams, and a variable path delay is introduced in one of the beams. The direct output of the spectrometer as a function of path delay is called an interferogram. The power spectrum can be obtained from it by Fourier transformation, which is usually performed on a digital computer. The principal advantage of interference spectroscopy is that for each spectral element, the integration time is the full recording time of the interferogram; thus, the signal-to-noise ratios available with interference spectrometers are higher than are those available with grating spectrometers. Therefore, for a given source and detector, improved frequency resolution can be obtained with interference spectrometry.

Two companies -- Sir Howard Grubb Parsons and Company Ltd., Walkergate, Newcastle upon Tyne 6, England, and Research and Industrial Instruments Company, 17 Stannary St., London, SE 11, England -- have been marketing interference spectrometers for two to three years. Details have, of course, changed over that period, but the basic design criteria were evolved from specifications originally supplied by Dr. H.A. Gebbie of the National Phsycial Laboratory, Teddington. Both companies have spectrometers that cover the range 10-500 cm^{-1} (1 mm-0.02 mm). Each instrument contains a mercury lamp source and a Golay cell detector, and the outputs are suitable for feeding a digital computer. Maximum theoretical frequency resolution of an instrument is equal to the reciprocal of the maximum difference in beam path-lengths. However, attainable resolution is limited by various other parameters such as marking intervals (sampling rates), drive uniformity, available source power per unit bandwidth, and detector sensitivity. Based on various specifications supplied by the manufacturers, I would guess that fractional resolution, depending on the model selected, is between 10 to 30 and 50 to 150 for wavelengths corresponding to 1 mm and 1/10 mm, respectively.

One manufacturer features a supplementary unit consisting of an analog Fourier transform computer at an additional cost of about $17,000, and the other manufacturer features direct teletype communications to the main plant where digital computing services are available at a nominal cost. The cheapest instrument sells for slightly more than $10,000 and the more expensive unit is sold for about $30,000. Although the instruments are far from being fool-proof, they certainly represent a major step toward the submillimeter region becoming one of the best instrumented for spectroscopy. (M.W. Long)

Services Electronics Research Laboratory, 21st Anniversary Open Days

For the first time in 21 years, the Services Electronics Research Laboratory (SERL) at Baldock, Hertfordshire, opened its doors to the public and presented a detailed status report on its unclassified research on 14 and 17-18 October.

SERL was founded in 1945 by combining several teams which had been working for the Admiralty during WWII on microwave valves and other vacuum tube devices. The laboratory specializes in active components, originally valves and gas discharge devices, but in recent years solid state devices have been emphasized.

Semiconductor research at SERL mainly involves the III-V compounds. The laboratory has made major contributions ranging from refining the liquid encapsulation technique for pulling single-crystal GaAs to advanced optical rangers, scanners, and communication links using carrier injection light sources and lasers made from advanced epitaxial III-V structures.

Molecular gas discharge laser research was pioneered at SERL by the investigation of nitrogen (L.E.S.Mathias & J. Parker, Appl. Phys. Letters 3, 16 (1963)). Water was extensively investigated (A.Crocker, H.A. Gebbie, M.F. Kimmittee, L.E.S. Mathias, Nature 201, 250 (1964)) and some 150 lines were characterized. Recent work (IEE.S. Mathias, A.Crocker, M.S. Wills, Electronics Letters 1, 45, 1965)) has identified even more spectral lines in compounds involving hydrogen, nitrogen, and carbon. Several CO_2 lasers were operating at the open house, and considerable emphasis is being placed on both improving and using this remarkable 10-μ source.

Research on ion implantation was demonstrated. Metal masks are used to provide geometrical resolution, and junctions in Si and Ge have been made with reasonable electrical properties after annealing. The consensus was that the value of this method will not have been demonstrated until ion implantation is utilized to make p- and n-type regions in a material (such as II-VI (ZnSe)) which has doping difficulties.

Major progress has been made in power capability of broad-band traveling wave tubes which can be achieved by mounting these slow wave structures on BeO (high thermal conductivity) supports. Present project goals are 5 kW cw in the 6 GHz band.

Recently the British press has given extensive coverage to the SERL research on neutron radiotherapy as an alternative to X-ray therapy (P.D.Lomer & D.Greene, Nature 198, 200; and D.Greene, Nature 202, 204 (1964)). The development of high output neutron tubes (10^{11}/sec to 10^{12}/sec) by SERL is the key to this exciting medical advance.

Visitors to the open days were met at the railroad station, escorted to the registration point, and left to find the well-marked exhibit areas. One interesting bit of information overheard in the halls was that a special open house was held for VIP's (Valve Industry Personnel). At each experimental site senior professionals were present to discuss the research. Live demonstrations were given whenever possible, and a short printed technical description was given to the visitor.

Should the reader desire more detail on the SERL programs, an ONRL Conference Report on the open house is forthcoming, and an article by M.S. Wills (Bul. Ins. Phys. & Phys. Soc. 17, 283 (1966)) would be useful. (P.D.Maycock)

International Conference on Luminescence, Budapest

Luminescence is one of the oldest phenomena of solid state science, going back in its early beginnings into the last century, long before any understanding of solid state effects in the modern sense of the word was even indicated. This long history and the fascination it always held for the applied scientist might possibly explain why it has been so susceptible to the "cook-book" approach, and is only gradually evolving from this stage. Possibly influenced by the big strides in which the understanding of recombination radiation is progressing, the field has taken a definite turn and the Budapest Conference testifies to this effect.

Numerous International Conferences on Luminsecence have been held in the past, the very first one on a large scale in Oxford in 1937. There was even an International Symposium on the subject in Hungary before, in 1961. The International Union of Pure and Applied Physics came into the picture in 1963, giving for the first time the Conference in Torun, Poland its truly international air. The Budapest Conference, held during 23-30 August 1966, was only the second one of the IUPAP-sponsored meetings.

The attendence was correspon ingly international. Over 400 people came from 28 different countries, counting the Federal Republic of Germany, the German Democratic Republic and West Berlin as separate countries, as is customary in this part of the world.

The 300 contributed papers were presented in a way that was novel, at least to this referee. Approximately 10-15 papers were arranged in a topical group and a scientist of international reputation reviewed and summarized these papers in a lecture of appropriate length. A discussion period followed, in which the authors them-

selves could elaborate on details and answer questions from the audience. All papers had been distributed in full length with illustrations at the beginning of the Conference, so that it was possible to go to the respective sessions well-informed. With one exception, the referee's spoke either English or Russian, and the text of each lecture was projected in the alternate language on a screen. If the quality of projection would have been better, this approach would have been superior to simultaneous oral translation.

This system of presentation of the contributed papers worked very well and gave the feeling of more internal coherence in a group of papers than is ordinarily experienced. The sessions would have been even more useful if more time for discussion had been available, but it was already necessary to hold up to four parallel sessions in order to deal with the huge amount of information. The field seems almost too big to be reviewed in one conference only. Future meetings may very well be split into smaller sub-groups of luminescence.

The President of the US National Academy of Science, Prof. Frederick Seitz, opened the Conference with a lecture on the "Future of Solid-State Science." He recalled in the beginning his personal attachment to Hungary through his teacher Wigner, and described how he had on the preceding day visited the house to which he had addressed so many letters during the vacations that Wigner was at home in Budapest. It was this life-time interest in solid-state science and his eminent contributions to the field that made Seitz's speculations on the future of this field so interesting, although somewhat saddening. Starting out from science in a broader sense, he divided it into interpolative and extrapolative science, and pointed out that many of the most significant extrapolative steps in science came out of studies that were initially intended to be interpolative. Seitz predicted that there will be a tendency in our society in the future to place an increasing difference in value on interpolative and extrapolative work, similar to the attitude that has long been applied in industry when supporting the two types of work. One compelling reason for this trend stems from the fact that, even at the university level, society begins to recognize the distinction between "little science" and "big science" and the threat that originates from the fact that "big science" could easily spend any fraction of the national budget made available.

So far solid state science has been an exception to the trend toward "big science" by still offering profitable exploitation of the field through the techniques of "small science." This is gradually being changed, however, and more and more extrapolative work is being identified with big science, as in other fields. In spite of all the large magnetic and cryogenic facilities available to some groups, it is evident that solid state science as a whole is becoming more and more interpolative and less and less extrapolative. Comparing science with a mining operation, Seitz clearly indicated that the times are past when only very rich deposits were exploited. To the past generation, only the major principles were of chief intellectual interest. Now, solid state science is characterized by an enormous growth of interest in the practical consequences, and the apparently leaner aspects of the field come to have increasing importance.

After a brilliant historical survey of the whole field up to the latest accomplishments, Seitz concluded his lecture by analyzing his own experiences over this period. He expressed his amazement over the tremendous growth of interest in detailed facts of solid state science, although it seems evident that there are very few outstanding mysteries extant at present and the field most certainly is no longer in its infancy. Coming back to his picture of the mining operation, he expressed his feeling that there is still some valuable ore left, but that it can be exploited only by methods tailored to make profit even from leaner minerals. Seitz's account of the future perspectives of solid state science was one of a series of introductory lectures. G.F.J. Garlick (Hull University, England) presented a review of luminescence centers in solids and V.L. Levshin (Moscow Univ., USSR) summarized the processes of energy transfer in the physics of inorganic crystal phosphors.

After this series of introductory lectures, the Conference broke up into four separate but parallel sessions, on general problems of luminescence,

the luminescence of organic and amorphous materials, the luminescence of inorganic materials, and special problems in luminescence. Since this writer is even more a stranger to the luminescence of organic and amorphous materials than to the rest of the field, he neglected this series in favor of others. The invited papers gave the impression, however, of the rapidity with which this field -- possibly the most susceptible to the cook book approach in the past -- is emerging from this stage and striving for theoretical models and interpretations.

The sessions on inorganic materials dealt with the luminescence of halogenides, sulphides and oxyphosphors. A brilliant lecture by H.Pick (TH, Stuttgart) reviewed progress in the field of the alkali halides, possibly the best understood part of the whole field. In particular, the application of electron resonance techniques has greatly improved the identification of the active centers, establishing model cases for the possible combinations in which disorder can perturb the ideal arrangement of the lattice. The basic processes which lead to luminescence seem better understood in the case of the color centers than in any other luminophor.

The studies on sulphide phosphors seem to offer greater difficulties, because the centers are less well defined. Studies of the emission, in particular at low temperatures and with respect to the degree of polarization, appear to open this field to theoretical interpretation. The difficulties are still formidable, however. In ZnS, for instance, years of work have been invested in establishing the mechanism of pair-luminescence, only to see the final proof of such mechanism being established in "easier" materials, such as GaP. Borates, oxides, halophosphates and other oxygen-dominated luminophors represent the subgroup of inorganic materials in which the fundamental processes are least recognizable at the moment.

The fourth big group dealt with special problems in luminescence, including the rare-earth activated luminophors and electroluminescence and injection phenomena. The application in lasers places strong interest in the rare-earth activated materials, with inorganic as well as organic substances as host lattices. The well-defined states of the rare-earth ions result in precisely structured spectra, which can be interpreted satisfactorily. Electroluminescence and injection phenomena also receive their backing from the application in light generation. The crucial problem here is the production of pn-junction as a well-defined source of injection. The basic mechanisms seem best understood in the materials in which the preparation of pn-junctions is possible, and further progress will largely depend upon refinement in the art of preparation. Electroluminescence is at its very best in the studies of pair-luminescence in GaP, as pioneered by M. Gershenzon and co-workers at the Bell Telephone Laboratories. The well-defined emission spectra, interpreted on the basis of pair-recombination of impurities at different lattice sites, seems to establish something like an "ideal" luminescence physics - a model case, on which the field could orient itself, if every material would have the convenient properties of GaP.

The organizers of this Conference in the Hungarian Academy of Science deserve credit for an organization which functioned very well in the technical as well as the social aspects of the gathering. Very little could be improved upon and their efforts in translating and distributing the pertinent material in time were exemplary and must have required a tremendous amount of work. They hope to have the full Proceedings ready early in 1967, published by the Hungarian Academy of Sciences. (B.O.Seraphin)

PSYCHOLOGICAL SCIENCES

International Conference on Applied Military Psychology

This Conference, the third in a series sponsored by the Office of Naval Research, was held in London, 3-7 October 1966. Representatives from military psychology programs in Denmark, Germany, Great Britain, Israel, the Netherlands, Norway, and the US, participated in a five-day period of extensive discussion of three problem areas. The agenda included consideration of non-cognitive factors in personnel selection, training of military personnel, and the impact of psychology on the military services.

Participation was limited to two delegates from each country occupied with full-time in-service military psychology programs. The focus of the Conference was on a review, discussion,

and critical evaluation of research methodologies, techniques, and fundamental issues arising from the agenda items. Position papers were prepared in advance and distributed to the delegates, but were not read at the meetings. The program was organized in such a manner as to facilitate spontaneous discussion and exchange of ideas in an informal atmosphere. In essence, the primary purpose of the Conference was to provide a platform for discussion on applied military psychology problems which is not available through the usual professional meetings and congresses. In order to encourage spontaneity and freedom of expression in a potentially sensitive area such as applied military psychology, no formal report or summary of the proceedings will be prepared. However, on the basis of the comments by the participants, it would appear as if this form of international gathering did, in fact, achieve its purpose. (J.E.Rasmussen)

NEWS AND NOTES

Upwelling?

Within the past fewweeks several oceanographers in the UK have commented to this author on an interesting phenomenon which has been observed to the north of England. Mr. R.I. Currie, newly-appointed Director of the Marine Station, Millport, Scotland, has also assumed the responsibilities of the Secretary of the oceanographic section of the International Union of Biological Sciences. Dr. Harold Barnes, also of the Millport Laboratory, was designated Chairman of the European Association of Marine Biologists which was created early in October at the First European Symposium on Marine Biology, Helgoland, Germany. Mr. R.S. Glover, Director of the Oceanographic Laboratory, Edinburgh, has been the Chairman of the subcommittee on Productivity in Marine Communities within the British National Committee for the International Biological Program. Speculation has centered on whether this concentration of productivity within a fifty-mile radius in Scotland could represent random distribution or if it could be attributed to upwelling. (J.D.Costlow)

New High Field Microscope to be Produced in England

Associated Electrical Industries (AEI) has six months of support in the form of a contract from the Ministry of Technology to take the prototype of Dr. Cosslett's 1-MeV electron microscope in to production. Options to buy have been placed by AERE, Harwell, the National Physical Laboratory (NPL) and other laboratories. This is an attempt to cash in commercially on the vast amount of scientific knowledge in this field available in the UK and to compete effectively with the Japanese in this area. Because, with a prototype available, the investment is relatively small but the sales potential quite reasonable, this is one of the areas the Ministry feels worth stimulating. (J.B. Cohen)

North Sea Pollution

Professor Dr. Otto Kinne, Director of the Biologische Anstalt Helgoland, Germany, has scheduled the 1967 International Symposium to celebrate the 75th anniversary of the Station. The Symposium, September 19 through 21, will emphasize "Biological and Hydrographical Problems of Water Pollution in the North Sea." As presently planned the general topic will be introduced by two invited speakers, one dealing with the general aspects concerning biological problems and the other, hydrographical problems. Submitted papers will be limited to 20 minutes, followed by a discussion period of 10 to 15 minutes. Selection of papers to be presented will be based on the pertinency to the general topic and, if necessary, the date of submission. Abstracts, to be distributed prior to the symposium, should be submitted before August 31, 1967. The papers, as well as the discussions, will be published in the Station journal, "Helgolander Wissenschaftliche Meeresuntersuchungen." Simultaneous translation in English, French, and German will be available for all papers.

Individuals interested in further details of this symposium should contact the Director, Biologische Anstalt Helgoland, 2 Hamburg 50, Palmaille 9, Germany. (J.D. Costlow)

Miscellaneous

Agreement for a working association has been reached between the Royal Aircraft Establishment (RAE Farnborough, and the Univ. of Southampton. This will provide for collaboration in teaching, planning, and execution of research, and scientists from RAE will be co-opted on the university staff and given honorary university titles. It will enable RAE equipment to be made available to

university research workers and RAE staff to study for higher degrees at the University. The first joint research programs will be in the fields of theoretical and experimental aerodynamics, acoustics, structures, automatic control, and materials.

The sub-department of Cloud Physics at Imperial College, London, has recently closed, but most of the research scientists, with their equipment, have followed Prof. B.J. Mason to the Meteorological Office, Bracknell, where a new branch for Cloud Physics has been established.

Four new English universities have been inaugurated for the start of the new academic year: the Univ. of Surrey, formerly Battersea College of Technology; the Univ. of Bath; the Univ. of Bradford, formerly the Bradford Institute of Technology; and the City University, formerly Northampton College of Advanced Technology.

F.A. O'Niens, Manager of Satellite Communications for the Plessey Company, has been seconded to World Satellite Terminals, a consortium set up earlier this year by Associated Electrical Industries, General Electric Company, and Plessey to build and sell complete ground stations for communications satellites. He will hold the post of Chief Engineer and General Manager of this group.

Prof. A.S. Duncan, Executive Dean of the Faculty of Medicine at Edinburgh Univ., has been appointed to a new personal Chair of Medical Education at the University -- the first chair of its kind in Britain.

Dr. C.B. Wilson, has been appointed to a new post of Director of Building Physics in the Dept. of Civil Engineering, Edinburgh Univ., under Prof. A.W. Hendry.

Dr. Peter Swan has returned to England after six years with U.S. Steel's E.C.Bain Laboratory for Fundamental Research. He is Senior Lecturer in the Metallurgy Dept. at Imperial College of Science and Technology, London.

Dr. J.L. Livesey is now Professor of Fluid Mechanics at the Royal College of Advanced Technology (proposed Univ. of Salford).

Prof. C.R. Tottle of the Dept. of Metallurgy, Univ. of Manchester, is taking a Chair at the new Univ. of Bath.

Dr. C.A. Taylor, Reader in Physics at Manchester Univ., has taken a Chair of Metallurgy at Cardiff University.

Dr. M.M. Woolfson occupies the Chair of Physics at York University.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York 09510.

ONRL-41-66	Some Programs on Millimeter & Submillimeter Wave Spectroscopy in Europe by M.W. Long
ONRL-42-66	European Nuclear Energy Agency: Its Functions & Background by J.W.Hemann
ONRL-43-66	Fundamental Research on Materials at the Atomic Energy Research Establishment, Harwell by J.B. Cohen
ONRL-44-66	Operational Guide to Synoptic Applications of Meteorological Observations from Satellites by A.D. Hamilton

The following conference reports are releasable to European scientists:

ONRL-C-18-66, Int'l Symposium, Joint Services Electrical Power Sources Committee, 1966 by P.D.Maycock

ONRL-C-19-66, 1966 Symposium on Gallium Arsenide by P.D. Maycock

ONRL-C-20-66, Electron Microscopy in Metallurgy; Conference Sponsored by British Institute of Metals, 28-30 Sept 1966 by J.B. Cohen

ONRL-C-21-66, Tenth Int'l Conference on Low Temperature Physics (LT 10), Moscow by R.S. Allgaier

ONRL-C-22-66, 16th Meeting of Int'l Committee on Thermodynamics & Electrochemical Kinetics, Budapest by A.L. Powell

ONRL-C-23-66, Combined Royal Aeronautical Society's Centenary Congress & 5th Congress of Int'l Council of Aero Sciences by H.E. Williams

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Office of Naval Research Branch Office London, England	2a. REPORT SECURITY CLASSIFICATION 2b GROUP

3. RIPORT TITLE

EUROPEAN SCIENTIFIC NOTES 20-10

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
N.A.

5. AUTHOR(S) (Last name, first name, initial)

Rasmussen, J.E. and Hewitson, Victoria, Ed.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)	
b. PROJECT NO. N.A.	ESN-20-10	
c. N.A.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	
d.	N.A.	

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510

11. SUPPLEMENTARY NOTES N.A.	12. SPONSORING MILITARY ACTIVITY N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473

UNCLASSIFIED
Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Acoustics Aircraft Space Technology Materials Computers Oceanology Microwave Spectroscopy Solid State Physics Psychology						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS)*, *(S)*, *(C)*, or *(U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

AD NUMBER: AD0806808

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 28 Dec 1966. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH

BRANCH OFFICE — LONDON, ENGLAND

TECHNICAL REPORT
ONRL-58-66

PSYCHOLOGY AT GÖTEBORG, SWEDEN

The Institute of Psychology
The Institute of Education
The Psychotechnical Institute

BY

JOHN E. RASMUSSEN

28 December 1966

TABLE OF CONTENTS

BLANK PAGE

PSYCHOLOGY AT GÖTEBORG, SWEDEN

The Institute of Psychology
The Institute of Education
The Psychotechnical Institute

INTRODUCTION

The University of Göteborg was established in 1891 as a private institution, endowed by local citizens. At the turn of the century the University concentrated its effort and limited funds on the humanities and languages. While its reputation was built in these areas, it also became known throughout Sweden for its excellent faculty salaries. In 1956 the University became part of the Swedish "state" system, although endowments held at that time remained at Goteborg. Income from this money now subsidizes faculty travel to professional meetings and a number of incidental expenses of the various University Departments and Institutes.

The main campus is located in the heart of downtown Göteborg. While the University has undergone a marked expansion since founding, the city of Göteborg -- the second largest in Sweden -- has expanded even faster. Thus, buildings are spread over such a wide area of the city that students actually find some difficulty in getting from one class to another. Psychology recently has been accommodated in spacious new quarters, although other Departments of the University even occupy scattered rental space in office buildings. The Medical School, which is now considered to be the leading faculty of the University, occupies a beautiful center on the edge of town.

The first true recognition of psychology at Göteborg was in 1912, when a Chair was established in Educational Psychology and Philosophy. The break with Philosophy came in 1939, with the establishment of a Chair in Education and Psychology. A separate Chair in Psychology was established in 1956, at the time the State took over the University.

THE INSTITUTE OF PSYCHOLOGY

Professor John Elmgren has held the Chair in Psychology since it was created in 1956 and has been a professor at Göteborg since 1939, when he was appointed to the then newly established Chair in Education and Psychology. In addition to Elmgren, the faculty of the Psychology Institute consists of one laborateur, Dr. S. Rubenowitz; two docents, Dr. J.W. Holley

and Dr. K. Larrson; three lecturers; and ten research students. Two special lecturers from the Department of Statistics and Physiology also are associated with the Institute. There are approximately 250 undergraduates in psychology, 50 graduate students, and eight PhD candidates.

Prior to occupancy of new quarters this fall, teaching was extremely difficult because of limitation in classroom size, and laboratory space was at a premium. The Institute now is located in two adjacent new buildings in downtown Göteborg, occupying the first two floors of one building and the ground floor of a second. The remaining space, approximately eight stories in each building, consists of private apartments. Classroom and office space should be quite adequate; there is a library of more than passing significance, as well as a room with a one-way mirror for use in teaching techniques of psychological testing. At the same time there has been surprisingly little space set aside for laboratory use. Elmgren and his colleagues actually drew up the floor plans for the Institute, so one would anticipate the layout would meet the needs at least of the present generation of faculty members. In passing, it might be noted that the Psychology Institute at Göteborg may have the distinction of being the only Department in Europe to have designed its quarters in such a fashion that the faculty offices and research space are separated from the classroom and general student area by locked doors.

There is close collaboration with the Medical School in both teaching and research. A Section on Animal Studies, headed by Dr. Larrson, is physically located at the Medical School. This Section, which has excellent laboratory facilities, still is far enough removed from the main Institute to create problems for students in attending class.

Generally speaking, Göteborg has never been particularly known for its academic program in psychology. While the training and curriculum does not differ significantly from that of the other Swedish universities in terms of course content and structure, there possibly may be less depth in the psychological training than is found at Stockholm, Uppsala, or even Lund. Moreover, the Institute has never really established a definitive research image, either within Sweden or in other countries. Probably the best known faculty member at Göteborg is Larrson; however, his research interests are very narrowly confined to the sexual behavior of rats. While quality of work has gained Larrson international repute in his chosen area of study, it is somewhat doubtful if any university could achieve major stature in psychology through the work of one man in this particular field of research. With the exception

of Larrson, and Rubenowitz who really is just beginning his work, research activity at the Institute appears to be rather diffuse and ill-defined. For a major university there is surprisingly little laboratory equipment. That which is available has for the most part been made by the individual investigators. Elmgren, who has a long-standing interest in EEG, has an eight-channel Grey-Walter instrument and a wave analyzer. At the same time the equipment is located in a room which has neither temperature nor humidity control, and one suspects that there may be a great deal of electrical interference.

Elmgren is a friendly and charming individual who expects to retire in the very near future. While he is a most gracious host, it is somewhat difficult to understand what he is attempting to do in his research. He has worked on studies involving factor analysis of EEG tracings, and now is concerned with establishing a link between alpha activity and metabolism, which in turn he believes to be related to body typology or constitution. Recently he has started a series of studies in the area of gerontology. Here he has two students working on the problem of intellectual flexibility and decline of abilities with age. The Rorschach and various aptitude tests are being used in this study. Elmgren hopes to determine curves for decline in productivity of industrial workers which in turn will lead to decisions as to when workers should be pensioned. Elmgren discusses outlines of research rather than data or publications, and one is left with the distinct feeling that it has been years since he has really been active. In fact, one suspects that much of the present diffusion in the Institute may be traced to the fact that to all intents and purposes Elmgren already has retired.

The brightest star on the present Institute horizon is Rubenowitz, a fairly recent (1963) PhD, who is young, extremely alert, intelligent, and active. The book growing out of his dissertation has been well accepted in Sweden[1]. Although Rubenowitz now has been on the faculty for about three years, his major effort has been devoted to building an applied and industrial psychology program. He is establishing a Department of Applied Psychology within the Institute, modeled somewhat after Magnusson's Section at Stockholm University. He also is working with the Swedish Military Psychology Institute on a major program of analyzing jobs in terms of physical requirements. In spite of his lack of publications to date, Rubenowitz is highly respected among Swedish psychologists and quite possibly will play a major

role in the development of the Göteborg Institute.

As indicated earlier, Knut Larsson is the only well-established investigator at the Institute. In contrast with his colleagues, Larrson has a highly sophisticated and well-equipped laboratory as well as no problem of research funding. In fact, some of his research has been supported by the US Public Health Service through the National Institute of Child Health and Human Development. He is fluent in English and eager to discuss his work with visitors. Several years ago he worked at the University of California, with Beach, under a National Academy of Sciences postdoctoral fellowship in physiological psychology.

For the past several years Larrson has focused on the study of neuroanatomical and biochemical correlates of sexual behavior in the albino rat. Larrson and his collaborators have found an area, the medical preoptic - anterior hypothalamic continuum, which is of essential importance to the sexual behavior of the male. Surgical destruction of this area abolishes sexual behavior, even though functioning of the hormonal system does not appear to be impaired. Larrson now is concentrating on the olfactory system, which has been shown to be of primary importance in both male and female sexual behavior. In a recent series of experiments, four of nine animals with lesions of the olfactory peduncle, which contains second-order olfactory neurons, evidenced a total loss of sexual behavior. Because of these unexpected results, future work will be concentrated on systematically producing lesions at various levels in the olfactory system. Lesions in the optic nerve resulting in blindness did not interfere with sexual behavior.

The biochemical components of the research, which is carried out in collaboration with the Biochemistry Department of the Medical School, are focused on the development of methods to measure change in hormonal level in the blood. It is anticipated that success in this area will lead to studies of the relationship between sexual activity and the output of hormones such as testosterone.

Jasper W. Holley recently completed the requirements for a Swedish doctoral degree in Psychology under Elmgren and has been appointed a docent in the Psychology Institute. Holley, an American who obtained a PhD under Gilford at USC, has been in Sweden for several years and plans to remain indefinitely at Göteborg. He has a long-standing interest in factor analysis and has published several papers in this area[2],[3]. He also has been concerned with a factor analytical approach to validation of the Rorschach[4]. In spite of his difficulties in

learning to speak Swedish, Holley appears to have been well accepted at the Psychology Institute.

THE INSTITUTE OF EDUCATION

The Institute of Education was created in 1955 at the time the Chair of Education and Psychology was separated. Professor Kjell Härnqvist was appointed to the Chair in 1958 and has directed the Institute since that time. Härnqvist is an extremely young professor, whose formal training and doctorate was in Psychology. From 1955 until he moved to Göteborg, Härnqvist was with Ekman at the Psychology Institute of Stockholm University. As is the case with the majority of the younger psychologists in Sweden, he started his professional career with the Military Psychology Institute.

The Institute is housed on one floor of an office building in a less prosperous section of the Göteborg business district. Space was a major problem until this past summer when the Psychology Institute moved to its new quarters and the vacated space was given to the Institute of Education. The present rather limited staff, all appointed by Härnqvist, is as follows: Docent, Dr. J. Dahllöf; Lecturer, Dr. A. Svennson; and two research assistants who are PhD candidates, B. Anderson and E. Wallin. Anderson and Wallin have few teaching responsibilities and are engaged almost full-time in research activity. Another eight to ten teaching assistants, who are working for the licentiate degree, are occupied half-time with classroom instruction.

While the Education Institute is not responsible for teacher training, they do offer one course which is required for a degree in Education and several more which are optional with Education students. Approximately 500 students enroll in the required first semester Educational Psychology course. Forty to fifty students continue into the second semester, although approximately half of these are psychology majors. An advanced course is offered to undergraduates both in education and psychology. There are approximately 20 students studying for the licentiate (graduate) degree in Educational Psychology and two PhD candidates.

The Institute of Education has a surprisingly active research program in view of its short history and limited staff. The research tends to be quite systematic and programmatic with individual studies being grouped into two or three major projects.

The first project area, Programmed Instruction, has

been fully described in Dr. John A. Nagay's excellent report, ONRL-6-66, "Programmed Instruction in Norway, Sweden, and Denmark." Accordingly, a description of this work will not be repeated here. It may suffice to say that in addition to Härnqvist having a personal interest in this area, he also directs a commercial organization doing work in programmed instruction. Last year Dr. Donald H. Bullock spent a year as a visiting docent at the Institute, working in the area of programmed instruction.

The second problem area is broadly concerned with the analysis of the Swedish gymnasium curriculum (the higher secondary school from which students enter university). The classical Swedish gymnasium curriculum permits students to enter one of five very clearly defined "streams" or "sides": general, classical, scientific, technical, or commercial. Obviously the stream which a student enters holds major implications for both university specialization and adult vocation.

The work accomplished to date in this project area may be divided roughly into two parts. Härnqvist has approached the curriculum from the standpoint of the students; and Dahllöf has carried out an extensive group of studies analyzing the gymnasium curriculum from the viewpoint of university professors and a cross-section of Swedish business and industry. The results of Härnqvist's and Dahllöf's studies hold many implications for educational and developmental psychologists beyond those directly pertinent to the Swedish educational system.

Härnqvist collected data on some 8000 adolescents through a systematic, nation-wide sampling procedure. Four specific groups of students were studied: students just entering the gymnasium, a sample failing to complete their course, a group halfway through the course, and a sample of 962 graduates. Data were collected through the use of questionnaires which yielded information regarding frequency and confidence of course or "stream" choice, motivation toward school subject matter, interests, vocational plans, and academic guidance. An extensive analysis and interpretation of this data has been published in the form of a book by Härnqvist and Grahm[5], which unfortunately is in Swedish.

Because of the magnitude of the data, no attempt could be made to present a detailed summary. The following general remarks, however, give some indication as to the nature of the findings. School grades prior to gymnasium have a predictive value in terms of the decision to continue on through gymnasium, the specific "stream" chosen, and confidence in having made the right decision. While social background appears important

in the student's confidence in his decision, it is less important in determining the choice of "stream." Here, occupational and educational status of the parents becomes important. Each of the "streams," except for the general, was characterized by specific interest profiles.

Dahllof's studies also have been brought together into a Swedish-language book(6). As indicated earlier, his portion of the project was concerned with adequacy of the gymnasium curriculum from the standpoint of the student's preparation either for university work or the business and industrial world. Information was collected both on rating scales and questionnnaires. Again, because of the magnitude of the project, only a cursory summary will be attempted here.

First, the entire gymnasium curriculum was divided into 65 categories on the basis of the subject matter. In one study, every full-time faculty member in the four Swedish universities existing at that time was requested to carry out a threefold rating of the 65 subject categories. Using a five-point scale, each category first was rated in terms of its importance for university study in the faculty member's specialty. Next, a rating was made of knowledge which new students demonstrated at the university in each category relevant to the faculty member's specialty. Finally, all faculty members were requested to rate each of the 65 categories in terms of their importance for general education. In another study, a similar series of ratings was carried out in a total of slightly over 1,000 separate departments in Swedish industrial and business concerns. A final series of individual studies was devoted to the importance of foreign languages as seen both by university faculty members and representatives of business and industry.

One of the most striking results of this research is the fact that the university faculty members generally considered studies under the broad head of "humanities" to be of more importance than those grouped under "science." A second somewhat unexpected finding was a surprising degree of agreement between the university faculties and nonacademic respondents with regard to the subject matter which is important in general education. Some differences were found between the two groups of respondents with regard to languages. Apparently the faculties considered proficiency in English, French, and German as equally important, whereas the nonacademic respondents were far more concerned with proficiency in English than in either of the other two languages.

The broad project area of curriculum studies has been somewhat dormant since publication of the two books in 1963. However, in the near future another group of large-scale

studies will be undertaken regarding the effect of the revised Swedish educational system on gymnasium curriculum. This promises to be a rather important venture inasmuch as extensive baseline data are available from the studies described above for use in evaluating the change in educational philosophy.

By far the most active and the largest project at the Institute of Education is that concerned with pupil adjustment. This is a longitudinal study that could be carried out only in a country such as Sweden, which maintains extensive public records on the total population from birth to death.

The impetus for the pupil adjustment project comes from a major primary school system reform in Sweden. For approximately 15 years experiments have been under way on curriculum changes in the first nine years of schooling, which are compulsory in Sweden. The focus of concern has been on the three-year period equivalent to the US junior high school. In the past, students have been "streamed" through a large number of diverse schools and curricula within school during this period. In 1962 the Swedish Parliament passed a law which made the comprehensive system mandatory. While the comprehensive program already had been adopted in some school systems prior to the 1962 Parliamentary ruling, all of Sweden's schools will be changed over by 1972. The change is being made by phasing out the old system over a period of time rather than by shifting students from one system to another.

As the shift will not be completed throughout Sweden for a number of years this provides an excellent opportunity for comparative studies of the two systems. Härnqvist and his colleagues began their studies in 1961, and it is evident that they will continue for some years, even after the complete change-over has been accomplished. The primary aim of the project is to compare the two broad educational systems with regard to their long-term impact on intellectual and psychosocial development.

Two separate sets of studies currently are under way. One, which began in 1963, is limited to the city of Göteborg school system. The shift to the comprehensive system will be completed in Göteborg at the end of the 1966 school year. However, by proper selection of schools, it has been possible to obtain the last sample under the old system and a comparable sample under the new system (N in each group > 5,000). In addition to information on academic achievement, extensive sociometric and questionnaire data also are being collected.

Härnqvist has been strongly influenced by J.S. Coleman's

book, The Adolescent Society, in designing the Göteburg study. Thus, the data will permit comparison of the two systems in terms of student attitudes, values, motivation, peer group relations, and subculture norms. Much of the questionnaire and sociometric data must be coded by graduate assistants but the actual data processing will be by machine. It is anticipated that this study will be completed sometime in 1968.

The second major substudy of the pupil adjustment project started in 1961. With the assistance of the National Central Bureau of Statistics, a 10% random sample was obtained of all sixth grade pupils in Sweden -- a total of approximately 10,000 children. Next, teachers throughout Sweden were requested to report on student achievement through the first six grades, as well as to administer an extensive test battery and questionnaire to the students. Inasmuch as participation was voluntary, the rate of return was startling. School record data was submitted on 98% of the students and the achievement test and questionnaire information was obtained on approximately 87% of the sample. Information was obtained on the parents' social economic background, the children's selection of comprehensive versus streamed schooling for the junior high school period, and attitudes towards further schooling. Roughly 50% of the subjects went into each of the two systems for the remainder of their compulsory education. Tests have been carried out at periodic intervals since 1961, and the first group of students entered military service this fall. In collaboration with Swedish military authorities, extensive follow-up studies will be conducted on the male students during their military service, which is compulsory in Sweden.

When one considers the size of subject groups, sampling techniques, and the homogeneous Swedish culture, the change in the Swedish educational system provides a rather remarkable opportunity for Härnqvist to conduct well-controlled longitudinal investigations. From an experimental design standpoint it is reasonable to predict that any differences in capability and performance effectiveness found over time in these two large samples may be attributed to the differences in the highly divergent school systems.

Several theoretical considerations have gone into foundation of the nation-wide study, although J. McV. Hunt's book, Intelligence and Experience, has had a particularly strong influence. One of the primary goals is to evaluate the differential effect which the two systems may have on development of ability to utilize native intelligence. It

is predicted that a difference will be found, particularly in the case of individuals from a lower socio-economic background who customarily have not gone into the old academic "stream" curriculum.

Because of the size of the sample, it also will be possible to study a number of socio-economic or "class" variables related to home environment. Of interest here is the question of the influence of the home "linguistic" environment on test performance, and the impact of the changed school environment on children raised in orphanages. Studies also will be conducted relating school environment and attitude.

The magnitude of this project is somewhat overwhelming to the visitor when considered in context with the size of Härnqvist's staff. At the same time, however, one cannot help being impressed with Harnqvist's concise formulation of plans, clarity of thinking, and obvious administrative skills. The data collection now has become routinized, and analysis will be undertaken by graduate students under the supervision of Härnqvist and his faculty colleagues. In fact, 20 graduate theses now are under way or have been outlined in this project.

GÖTEBORG PSYCHOTECHNICAL INSTITUTE

The Göteborg Psychotechnical Institute is a private organization founded about 1940 by Professor Elmgren. Although the Institute is not particularly stimulating from a research standpoint, at least passing mention is considered appropriate inasmuch as it is the largest private industrial psychology organization on the west coast of Sweden.

This Institute occupies space in an old, dark, high-ceilinged office building in the heart of the Göteborg business district. It employs a total staff of about 30, most of whom have at least a first degree in psychology, and there are five affiliated organizations outside of Göteborg.

The primary activity of the Institute is personnel selection for industry. Over the years the organization has routinely selected bank employees and various types of industrial workers. There is also an executive selection program which appears to be less extensive in scope.

The organization is self-supporting and has a separate research budget -- part of which comes from outside grants or contracts. In the past, tests have been developed for use in the Swedish school system in differentiating pupils, and the Institute also has developed a mechanical aptitude test which is currently

used in the Swedish military psychology program.

The Psychotechnical Institute was owned and run by Professor Elmgren as a private enterprise until last year. For some time he had expressed a hope that the Institute would eventually become part of the University. However, this did not come to fruition and he sold the Institute to the employees. He has remained as a consultant and apparently spends a fair amount of his time on Institute activity.

On brief exposure to the Institute one is left with the feeling that it might be best characterized as an organization which is dedicated to methodically applying accepted techniques to fairly routine problems. It is doubtful if the organization will contribute any major theoretical break-through in the area of industrial psychology.

REFERENCES

(1) S. Rubenowitz. Emotional flexibility-rigidity as a comprehensive dimension of mind. (Almqvist & Wiksell, Stockholm 1963), 256 pps.

(2) J.W. Holley. A note on the relationship between Q and R factors. Scand. Jour. of Psych. 5, 143-148 (1964)

(3) J.W. Holley and J. Helander. Note on the prediction of factorially complex classes. Scand. Jour. of Psych. 6, 80-84 (1965)

(4) J.W. Holley, G. Fröbärj, and K. Ekberg. On the validity of the Rorschach Test, Scand. Jour. of Psych. 6, 7-18 (1965)

(5) K. Härnqvist and Å. Grahm. Vägen Genom Gymnasiet (Statens Offentliga Utredningar, Stockholm, 1963)

(6) U. Dahllöf, Kraven på Gymnasiet. (Statens Offentliga Utredningar, Stockholm, 1963)

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*
Office of Naval Research, Branch Office
London, England

2a. REPORT SECURITY CLASSIFICATION
Unclassified

2b GROUP

3. REPORT TITLE
PSYCHOLOGY AT GÖTEBORG, SWEDEN: The Institute of Psychology, The Institute of Education, The Psychotechnical Institute

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*
N.A.

5. AUTHOR(S) *(Last name, first name, initial)*
RASMUSSEN, John E.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
28 December 1966	12	6

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
N.A.	ONRL-58-66
b. PROJECT NO. N.A.	
c.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)* N.A.
d.	

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
N.A.	N.A.

13. ABSTRACT

This report describes the organization, staff, and current research activity in psychology at Göteborg University and the Psychotechnical Institute.

DD FORM 1 JAN 64 1473

UNCLASSIFIED
Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Psychology in Sweden Göteborg University Psychology Institute Education Institute Psychotechnical Institute						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

AD NUMBER: AD0808563

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 31 Jan 1967. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

Form 1473

(b) (6)

808563

AD No.
DDC FILE COPY

OFFICE OF NAVAL RESEARCH
LONDON

(6) EUROPEAN SCIENTIFIC NOTES No. 21-1,

(10) J. E. Rasmussen Victoria S. Hewitson

[redacted]-1

(11) 31 Jan[redacted]67.

(12) 21p.

Distributed by the
Office of Naval Research Branch Office,
London

(b) (6)

(265 000)

(b) (6)

OFFICE OF NAVAL RESEARCH
LONDON
EUROPEAN SCIENTIFIC NOTES

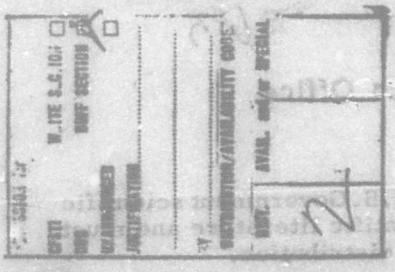
Edited by J.E. Rasmussen and Victoria S. Hewitson

31 January 1967 Vol. 21 No. 1

European Scientific Notes is Group II Newletter type Class B periodical prepared and distributed by the Office of Naval Research London in accordance with NAVEXOS P-35.

(b) (6) [redacted]

J. L. CARTER
Commander, USN
Acting Commanding Officer



AEROSPACE

SPACE RESEARCH IN ISRAEL

Work in space technology will probably have slight impact on Israel's pressing problems in this decade: pushing its green line further into the Negev, equipping and supporting its military services; or developing its industrial productive capacity. Ten years hence such work may well make quite substantial contributions toward just such objectives. Perhaps it is a realization of this potential that has stimulated the entry of this tiny nation, beset with so many diverting problems today, into the space technology research which can pay off only in the future. But then, as any visitor quickly learns, it is a country which looks always toward the future.

Israel has no NASA. The principal coordinating body is the National Committee for Space Research of the Israel Academy of Sciences and Humanities located in Tel Aviv. The Executive Secretary is Dr. E. Lahav, a knowledgeable gentleman with a capability of putting his finger on most space-related research in the country. Lahav is an organic chemist and is quite familiar with the US and our programs, having spent the years 1956-1962 as Scientific Counselor of the Israeli Embassy in Washington. The Committee is two-and-one-half years old and has only two assigned responsibilities: 1) to coordinate space research within the country, and 2) to represent the country internationally, i.e., to COSPAR, CNES, NASA, etc. It is significant that the Committee does not have an assigned responsibility for "stimulating" or "creating" space research. That would probably be too much. But the Committee definitely recognizes and its spokesman is quick to extol the potential benefits of space research in new materials and processes as well as in education and commerce. The Committee prepares an "Annual Report on Space Activities" which would most likely be available to interested readers. Some of the work described in the Report is directly in space technology: collection of data from weather satellites, preparation of sensors for planetary probes. However, other work is more general or only "space-related": for example chemical reactions in shock tubes and dynamic stability of conical shell structures. The total research program is estimated at about $2 million (US equivalent). The actual cost in Israel is probably half that since scientific labor in the country is cheap. Whereas, a research physicist costs in excess of $50,000 per year to support in the US, it is claimed to cost less than $25,000 to support the same quality man working in Israel.

Most space research in Israel is carried out by the universities. These splendid establishments have been described in several recent ONRL reports (e.g., see Epstein ONRL-34-66, Tyree ONRL-24-66, or Brennan ONRL-23-66). .. few of the more interesting projects now underway which were reviewed during a visit in December 1966 will be mentioned.

Tel-Aviv University - The newest of Israel's universities at Ramat-Aviv boasts an "Institute of Planetary and Space Sciences." Its acting director is Dr. Uri Shafrir, a young UCLA-trained physicist. There are six PhD's in the Institute with five others working toward their degree there, and some fifteen technicians. The Institute has had a cosmic-dust research program since early 1965 working partly in conjunction with the Institute of Geophysics and Planetary Physics at UCLA. They have developed and fabricated thin foil collectors which have been flown as part of the NASA LUSTER Program on Gemini's 9, 10, and 12. (You may recall our astronauts lost this experiment in space during Gemini 10 -- it's still out there!) The collectors which were recovered are being analyzed by electron microscopy, measuring the size and shape of holes punctured in several layers of nitrocellulose film and examining the collected particles. The particles so far collected and analyzed measure 0.2 to 1.0 μ with velocities of 11 to 72 km/sec.

Laboratory studies are being made at the Institute on hypervelocity impact of small particles on very thin foils by use of a shock-wave gun capable of velocities of 10 - 12 km/sec. Parameters measured are ratio of the initial impacting mass to the ejected mass, influence of velocity on ratio of particle size to the crater or puncture size on foils, and refracto... of a beam of particles impacting at various angles less than 90°.

The Institute has constructed and is operating an APT readout station to work with US meteorological satellites, which were, at the time of my visit, Nimbus II and Essa II. The terminal was just being completed, employing a 7-turn, servo-controlled, helix antenna on the roof of the Institute, no preamp, a Noma-Clarke IF demodulator and telemetry receiver, and a Sony-#5OOA tape recorder. None of the electronic equipment was built in Israel. The facsimile equipment had not arrived, and until arrival Video pictures were being stored on magnetic tape. They were projecting IR pictures on a CRT. Signal strength was 5-8 mV without a preamp, noise level never higher than 1 mV.

Other work at the Institute involves experiments in plasma physics, fluid dynamics, and astrophysics. Space-related work in the Physics Department at Tel-Aviv University includes work on mathematical models for quasi-stellar sources and for an expanding universe in conformally flat coordinates. The Applied Mathematics Department is working on problems in the propagation of sound in rarefied gases, in the interaction of explosives with a surrounding elastic sphere, and in flows of shock waves in strong magnetic fields.

The Technion - Israel Institute of Technology, Haifa, conducts research in space-related technology mostly through its Department of Aeronautical Engineering under Prof. Joseph Singer. The work of this Department has been in such related areas as instrumentation for high altitude sounding rockets, wing flutter in supersonic flows, theoretical studies of MHD flows, and stability in conical and cylindrical shells.

An optical tracking facility established in association with the Smithsonian MOONWATCH program was in operation in the Department last year, under the auspices of the Israel Astronautical Society. Apparently, interest has waned since the facility was not very active. This seems unfortunate since the "seeing conditions" in the area are quite good. Dr. H.J. Shafer, one of several transplanted Americans in the Department, is working on a quick readout device for an optical telescope which will utilize an electronic pick off at the focal plane and magnetic tape storage. He is engaged in a tradeoff study of accuracy versus speed for such a device.

Prof. Moshe Zakai of the Department of Electrical Engineering is doing interesting work in information theory as applied to electronic systems. Research is in progress on probabalistic coding and decoding techniques, signal scattering effects from moving objects, tracking error analysis, theoretical effects of noise in nonlinear devices, and signature analysis of space radar returns.

Radio Observatory, Haifa - This quasi-governmental installation performs ionospheric research under the direct auspices of the National Committee for Space Research. The Director is Dr. Jonathan Mass. Several scientist-operators are on loan from the Technion staff. Support has been received since 1964 from the USAF Cambridge Research Laboratory. The station has utilized CW transmission from the NASA Ionospheric Beacon (S-66) to determine the ionospheric electron content and to study ionospheric irregularities. Reports on this work are available. The station expects to install a 1-20 MHz iono-sounder for the Israel Ministry of Posts (PTT). They are also interested in performing UHF work, particularly in doppler tracking and in studies of ducting phenomena at low antenna-elevation angles.

Hebrew University, Jerusalem - Prof. J. Neuman, ably assisted by Dr. Avraham Buss, directs an active Meteorological Department located in an old part of the city of Jerusalem, unfortunately for them and not at the splendid new campus on the western outskirts. The Department is doing excellent work on numerical weather prediction using many factors, and has performed some interesting cloud seeding tests intended, one presumes, to produce rain right up to, but certainly not over the border (or to use the local phrase "frontier"). They are working on measuring ozone concentrations above 50-km altitude; they have access to Tiros data from NASA which is in the process of being analyzed; and, to go even higher, Dr. I. Steuer, in a small workplace which looks like a high school physics laboratory of 1930 vintage, was proud to demonstrate his in-house-developed variable capacitance barometer designed for a Mars landing.

Dr. D.S. Frankel of the Physics Department (which does reside at the new campus) has made several important contributions to the identification of

highly ionized atoms by differentiating lines in the far ultraviolet spectrum of the solar corona. This has been helpful to many American rocket spectroscopists, and work has been supppr-ted by the USAF OSR. Research is planned to extend the analysis to stellar coronae in the future. Fraenkel has mapped out a program to classify atomic lines according to the degree of ionization and spectroscopic transition for third and fifth row metals, using wavelengths from 40 to 500 Å. Attempts will be made to obtain all the coronal lines in the laboratory and correlate these with astrophysical data.

Ministry of Posts (PTT), Tel Aviv - Mr. Y. Levi, ex-Chief of the Army Signal Corps, is the Director General and Mr. Berman, Chief Engineer of this vital Ministry. Internal communications in Israel - like almost everything else in the country - has doubled in the last five years. This Ministry provides representation to Intelsat, and the country's interest in communications satellites is strong. At present only 17 HF telephone circuits connect Israel to the outside world, and at any given time 50% availability of these is the rule. Installation of their first cable, to France, will start early in 1967, finish in 1968, and provide 96 4-kc channels. Still they are most interested in communications in other directions and feel their country would be ideal as a communication satellite relay point. In discussions, the one point that seemed, not surprisingly, to fall flat was any reasonable hope for an area distribution system. Israel has asked for siting aid and technical communications satellite terminal advice from the ITU. This has not been forthcoming for administrative reasons, and the principals are now considering asking industry for technical assistance. (B.I. Edelson)

BIOLOGICAL SCIENCES

"TOWARDS THE BIOLOGY OF TOMORROW" THIS, OR A DEAD-LOSS?

EURATOM, the bulletin of the European Atomic Energy Community, carried a very thought-provoking article in its December, 1966, issue (Vol. V, No. 4, 98). The article, "Towards the biology of tomorrow," is part of an address by Dr. Raymond K. Appleyard, Director of Biology Services, Euratom. While one cannot do it justice in abstract form, it seemed sufficiently worthwhile to try in the interest of stimulating some to look up and read the entire address.

Modern concepts of physics and chemistry, having evolved from the revolution which has been occuring during the past sixty years, have eliminated the inhibition and mystery previously associated with the study of life. The incorporation of some of these concepts into biological research has led to a series of "astonishing discoveries" since 1934, including the detailed description of the physico-chemical structure of genetic material, the scheme by which it and derivatives control life processes, and the duplication of genes. These developments have led to a more complete merger of the biological sciences with the physical sciences, instilling a new facility and coherence into the teaching of biological subjects and permitting new and freer patterns of ideas and the convergence of thoughts and research efforts. The author contends that all of this must be viewed against the socio-economic background of our time with special emphasis on the role and responsibility of governments in the administration and control of "Society's surplus," be this surplus money, brains, or research. The investment in the future made through research varies from perhaps 1-2% of the gross national product in some West European countries to 3-4% of the American GNP. These vast expenditures on scientific research have had a number of effects already. Research has now become a career in itself, and, in some areas, has become dominated by 100% research institutes. Although the needs have never been greater, universities find themselves relatively handicapped by partial commitments to teaching, with the exception of those sufficiently large to have some staff devoted to teaching, others to research, and still others to portions of each, with the ratio varying during different phases of their careers.

If we accept the role of governments in setting the general trends by the magnitude of the allocations, we must also see that the task of allocating is well done. Comparing what the author calls "transforming power" of biological research with

that of nuclear research, in view of relative expenditures, the long standing neglect of support for the former in terms equal to its importance should be corrected. In the event that this should happen, we must be prepared to accept responsibility for seeing that the necessary decisions are made with full and objective knowledge of the potentialities of the field and also recognize that the tremendous expansion which results will bring specific difficulties to the life sciences. One problem, and perhaps the most serious, is the supply of trained brains. If plans are to be made to increase this supply significantly within the next thirty years, the pattern of training and available opportunities for research in the realm of merged disciplines must be laid down now. One inevitable result will be "big science," programmed research, and geographically dispersed networks of related programs. It will be essential that these be adjacent to permanent, non-project research institutions so that mutual exchange of skills and men will be possible. We need to accept the concept that a man may spend a few years on loan to a project, a few with a little teaching and much research, and at the end of that period he (supposedly) will be better prepared to do more teaching and less research. In this way it should be possible to combine the professionalism and overall purposefulness that is needed in research with the close relation between teaching and research. The author comments on the need to achieve a correct balance between so-called basic and applied research, indicating that the distinction in its simplest form is naive, dangerous, and not exact. He suggests an intermediate zone, oriented research, where efforts would be directed toward shedding light on a group of problems rather than attacking them head-on. The old distinction has separated scientists into two camps and restricted and retarded necessary exchange of ideas and people and implementation of results.

The "fun-period," when new discoveries could be made with two water baths and a refrigerator, is now shortened or virtually vanished altogether. Research by teams, which change in composition to bring new ideas and techniques to bear on a problem, will continue to grow in importance. There is great need for cooperation of individual groups within a wider network, bringing into focus with the larger groups the efforts of smaller groups and thus realizing the fuller potential of all. A complex organization, not yet fully explored, will be required to assure a maximum of exchange of ideas and realignment of the "ad hoc" teams. If the concept, a research community, is not promoted in the life sciences, the present efforts will come to a dead loss "here in Europe."

In concluding the author suggests, to those who govern and to those who direct, that the life sciences be given the resources appropriate to their potential. At the same time emphasis should be placed upon equal recognition of all disciplines and those individuals involved in fundamental research, applied research, and teaching, insisting upon maximum freedom of movement of men and ideas and the encouragement of all institutions to engage in their full role of mutual help in the total network of the biological sciences.

In the U.S. the transformation to which Appleyard refers has been underway for some time, be it planned or accidental, and I'm sure that most biologists can recognize the particular stage which they, their research interests, and institutions have attained in the over-all development. From time to time one feels that the analysis of the total problem has not been as objective as would be befitting the scientific community. In many cases there has been a general reluctance among scientists to recognize that a transformation exists and to accept the frequently less than welcome and time consuming responsibility which Appleyard indicates is essential. While the "fun-period" may be in its twilight years, I would hope that the individual, to whom no reference is made, will not become extinct. We may have uncovered the physico-chemical basis for a number of isolated parts, but there is still the little matter of putting them together again, first as an integrated living being and then as a community. There undoubtedly will be those biologists who do not agree with Appleyard's analysis of the situation or his recommendations, but if not, they should (having first read the entire article) be prepared to offer an alternative in an equally logical fashion. This will not be easy. (J.D. Costlow, Jr.)

EARTH SCIENCES

OCEANOGRAPHY COMES OF AGE

The First International C gress on the History of Oceanography, recently held in Monaco, seems to have accomplished several things. First, assuming that such a basis was necessary, it established oceanography as a respectable area in which to conduct historical studies. A number of faculties in American universities are being set up for this purpose, and if only because the development of the subject has occurred largely within the last 100 years and virtually complete records are available, the subject is very suitable for examination at this particular stage in its evolution. Secondly, with the recent emphasis and expansion of offshore activities of a commercial nature, it would seem appropriate to re-examine some of the various techniques and hypotheses in the interest of providing clues which might assist in the solution of present day problems. The Monaco conference also provided an opportunity for the specialists in the more applied aspects of oceanography to meet with those who are more familiar with the historical aspects of the subject.

As with any detailed examination of "historic fact," a certain amount of debunking was to be expected. The professional historians have now come to the conclusion that Maury, the man generally credited with initiating oceanography in the US, was actually a career officer rather than a scientist (this apparently should make a difference?). The view was expressed that for the period, superior oceanographic studies were being carried on by Ferrel, with whom Maury disagreed. In attempting to find a lesson for today, the recent account of the meeting in the New Scientist selects the Challenger expedition of 1872-76. There is general agreement that the expedition established oceanography, especially in the geological and biological sciences. The article points out, however, that the money spent on the expedition was comparable with that supporting modern science projects and that the British Treasury was extremely difficult in its dealings with the chief scientist, W. Thompson. In concluding, the article suggests "those in the Treasury who today wish scientists to account for every penny should examine their true motives before they behave in a similar fashion."

From this author's point of view, historical analysis requires the same caution that statistical analysis demands. Otherwise, one may get the answer he was seeking in the first place. In so far as modern treasurers, scientists, and motives are concerned, a standard procedure involving a little consideration and responsibility on both sides would frequently go a long way. (J.D. Costlow, Jr.)

GREAT METEOR BANK

A recent article in the German Tribuna (weekly review) discloses plans for an "Atlantic Peaks Expedition, 1967" beginning on 11 January. The announcement was jointly made by Prof. Dietrich and Prof. Seibold at a combined meeting of the Hydrographic Institute and the Federal Research Association.

The research ship METEOR (named after the old ship METEOR which first explored this seamount in 1938) will support four rotating teams on this six months' expedition during which data will be collected for analysis by geodesists, geologists, geophysicists, oceanographers and marine biologists. It is expected that these analyses will consume five to ten years' effort.

Although emphasis in this area will be on geophysical studies, there are four other areas in which physical oceanography takes center stage, and the over-all program includes a broad spectrum of factors, e.g.: temperature, salinity, current, and bottom and subbottom profiles; an underwater television camera is also available on board. (Joseph E. Bennett)

AUTOMATIC PLANKTON SAMPLER

During a recent visit to the Port Erin Laboratory, Isle of Man, UK, Dr. D.I. Williamson described an improved model (Mark II) of the automatic plankton sampler which he designed several years ago. While the sampler should not be considered in the same category as the Hardy Plankton Recorder, it possibly would be a very useful tool in estuarine and marine research. If the weight is reduced as he expects by the use of plastics, it could be used by one man and a small power boat. If the cost is brought down to approximately $280.00, as expected, it would also be possible to consider the use of several samplers at different depths.

Williamson has provided a description of the modifications which are underway in the interest of bringing this information to the attention of ESN readers. Anyone interested in further details should write Williamson.
(J.D. Costlow, Jr.)

AN IMPROVED AUTOMATIC PLANKTON SAMPLER

A Mark II model of the automatic plankton sampler described in 1963 (Bull. Mar. Ecol., 6, pp. 1-15) recently has been developed. In both versions the towed instrument takes a series of up to 20 plankton samples, each of pre-determined towing-distance, without attention from the time of launching to the time of hauling. Each sample is collected in a small net, and methods of killing the plankton in the net are described in the 1963 publication. The plankton sampler may be used with a submarine depressor at any depth or without a depressor for sampling near the surface.

The prototype of the Mark I version has been in use since 1957, and a number of models have since been made, either as copies of the prototype or departing very little from the original design. This version has been sufficiently successful to establish the usefulness of this type of sampling apparatus, but it has a number of limitations. Experience gained with it has led to the design of the Mark II sampler which should be a more reliable and more versatile instrument whose weight and cost will each be about one-third those of the Mark I version.

The Mark I automatic plankton sampler is made of brass. A spring-loaded trap-door over each net can be held in a raised position by a catch; when the catch is depressed by a traveling cam, the door snaps shut to close off the net. A rotator towed behind the sampler operates through reduction gearing to turn a 30-inch lead-screw, along which the traveling cam slowly moves. Before the commencement of sampling, the traveling cam is wound to the front of the sampler and all the trap-doors are set in the raised position. As the plankton sampler is towed, water is diverted by the first door into the net below it. When its catch is operated by the traveling cam, this door moves against the stream of water, under the action of its spring, to close off the first sample in the first net. Water then passes over this door to be diverted by the second door into the second net, until the traveling cam operates the second catch, and so on. The length of each sample, of course, depends upon the reduction gear used; samples each of 4 sea-miles have most commonly been used with the Mark I plankton sampler, allowing a line of up to 80 sea-miles to be sampled without hauling the instrument. It has a sampling-aperture of 3/4-in^2, and is effective at towing speeds between 4 and 10 knots.

Some of the disadvantages and limitations of the Mark I automatic plankton sampler are as follows. At 85 lbs, it is inconveniently heavy for handling at sea on small vessels. At £250-300 ($700-840) it has proved too expensive for many interested planktologists, particularly those who would have liked several for such purposes as simultaneous sampling at different depths. Brass is subject to slight surface corrosion in sea water and careful servicing is necessary to ensure that corrosion patches do not form where they could interfere with the movement of the doors. The doors close against water pressure and this pressure is proportional to the square of the towing speed; strong springs are needed to close the doors even at moderate towing speeds, and any weakening of the springs with age leads to failures in operation; for towing speeds of 12 knots or more the springs would have to be prohibitively strong or the sampling-aperture drastically reduced. The reduction gearing gives the traveling cam large reserves of power, but the cam has no direct action on the doors (only on the catches), so that a door jammed open by a sand grain or corrosion will stay open when the cam operates the catch, and no samples will be taken by the subsequent nets.

The Mark II automatic plankton sampler should overcome all these disadvantages of its predecessor. Most of the instrument will be moulded in "fibreglass," with consequent great reduction in weight and elimination of corrosion. This method of manufacture also leads to a large reduction in cost, since the moulds used in the production of the prototype can be used for making further models relatively cheaply. In place of the trap-doors of the Mark I sampler, a type of cylindrical valve has been introduced (see Fig. 1). The stream of water, instead of opposing the movement of the deflecting plate from the raised to the horizontal position actually gives slight assistance to this

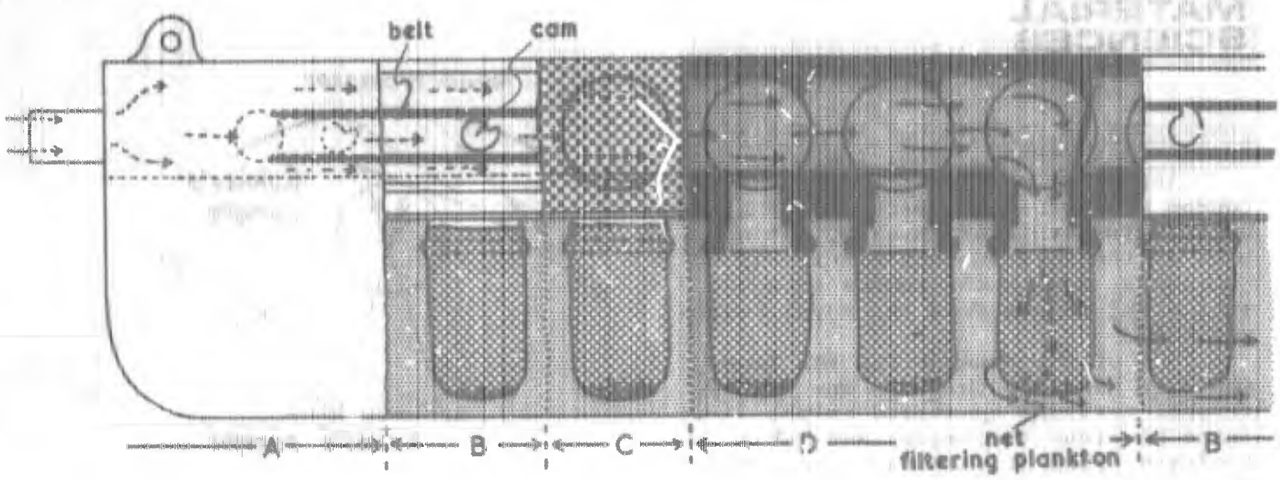


Fig. 1. Diagrammatic side plan of front end of automatic plankton sampler, cut away to different levels from left outer cover (A) to mid-line (D). Arrows show flow of water through the instrument. (Figure by permission of Coe's (Derby) Ltd.)

movement. Strong springs to overcome water pressure are therefore no longer necessary, and the potential maximum operating speed of the sampler is greatly increased. In place of the traveling cam, lead-screw and door-catches, all situated on the top of the Mark I sampler, the Mark II design employs a driven belt on each side of the sampler and simple cams on the ends of the axle of each valve. A projection on the belt engages with each cam in passing to initiate the turning of the valve, and this movement is completed by a light spring, assisted by the flow of water. Each valve is therefore set in motion at the appropriate time by direct application of power from the gear-box, in contrast to the indirect system used in Mark I. The belt drive of the Mark II sampler allows an increase in the length of the instrument which would have been inadvisable using an unsupported lead-screw as in Mark I. The greater length allows bigger nets to be used, which in turn permits either a larger sampling aperture or longer samples than are possible with the Mark I version.

A firm of plastics engineers, Coe's (Derby) Ltd., Thirsk Place, Ascot Drive, Derby, England, have prepared working drawings for the production of the Mark II automatic plankton sampler and are making the prototype. This will be tested at sea during the spring of 1967, and as soon as these tests are completed the firm will be prepared to accept orders for production models. There are good prospects that the cost of such models can be kept below £100 ($280) each.

The following table summarizes the main characteristics of the Mark II automatic plankton sampler:

Length (excl.rotator on flexible line): 5 ft 10 ins (approx)
Length (incl.rotator on flexible line): 11 ft (approx)
Width (excl. fins): 6½ ins (approx)
Width (incl. fins): 1 ft 6 in (approx)
Height: 8 ins (approx)
Weight: less than 40 lbs
Max diameter of sampling aperture: 1 in
Filtering area of each net: 18 in^2
Towing distance per sample (depending on reduction gearing supplied): ½ - 20 miles
Range (towing distance for 20 samples): 10 - 400 miles
Effective towing speeds: 4 - 20 knots (A larger rotator may be fitted for speeds below 4 knots.)

(D.I. Williamson,
Marine Biological Station,
Port Erin,
Isle of Man, UK)

MATERIAL SCIENCES

CONFERENCE ON SMALL-ANGLE SCATTERING, 17 and 18 NOVEMBER, 1966, LONDON

About 200 people attended this London Conference, sponsored by the British Institute of Physics. It was held at the Institute of Electrical Engineers, facing the Thames Embankment right across from the Royal Festival Hall.

One of the reasons for the large audience was that this was one of the several meetings sponsored by the joint Electron Microscopy and X-Ray Analysis Group of the Institute, and there were many microscopists in attendence. (We could do with more of this cross fertilization at smaller meetings in the US.)

Twenty papers were given--four major introductory talks and the remainder on more specific research work; two of the latter papers were from Germany, one from France. Some 25 attendees were from the Continent.

The main features of the meeting were the complete absence of talks on slit corrections, and the large number of papers devoted to small-angle scattering in electron diffraction, which clearly has the potential of replacing X-rays for much work on materials with large "d" spacings.

Prof. A. Guinier (U. of Paris) opened the meeting with a very interesting historical sketch of the field. He pointed out that Raman had first observed small-angle X-ray scattering in the '30's but that little was done with this observation. Guinier was at that time working in Prof. Mauguin's laboratory where Laval, also a student, had found some unusual diffuse scattering from powder specimens, using a counter and the curved crystal monochromators designed by Cauchois for spectroscopy. Mauguin asked Guinier to repeat this work with film methods. He set out to do this by working in transmission -- devising the Guinier focusing powder-camera, simply by changing the location of his specimen compared to Laval's, as shown in Fig.1. He used slits in the beams to and from the monochromator, put the apparatus in vacuum, and used a direct beam trap. The advantages at low angles were immediately apparent from the low background scattering in this vicinity.

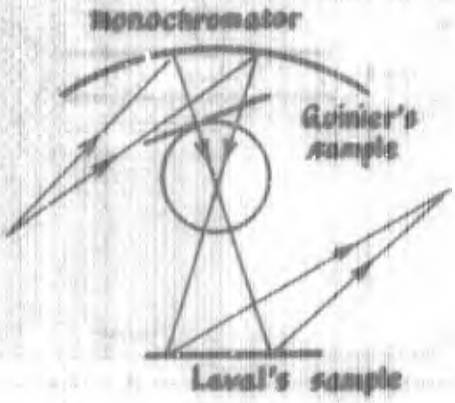


Fig. 1

At first he looked for the large-angle diffuse scattering, but found nothing. Laval had already switched to single crystal specimens, and had identified that the origin of the effect was due to thermal vibrations. Guinier then looked for uses for his camera and tried some amorphous materials, glasses and silica gel, catalytic nickel and carbon blacks. The large scattering readily observed was immediately pursued. From experiments involving increasing exposure times, it became clear that the intensity was diffuse and fell off with angle, and that any maxima was often behind the beam trap. These results led him to derive his well-known exponential law for the radius of gyration. In 1938 a metallurgical group, including Jacquet, were trying to find the reasons for the strength of age hardenable Al-Cu alloys, but even their special polishing techniques detected nothing. They gave Guinier some specimens, and the streaks he detected in these were the first evidence of effects due to shape.

Following this initial work, there were a number of important theoretical contributions. Ewald introduced the form factor and showed that at low angles the shape was the most important term, that strain in the structure or atomic arrangement was only important at higher angles. Debye introduced the convolution of the Patterson function obtained from the Fourier transform of

the scattering curves, but the information from this was perhaps too general. Porod assumed two regions of different density, with a sharp interface, and could then derive more specific results from the Patterson function, such as the surface to volume ratio. Even more important, he showed that one could get this information directly from the data without inverting it.

There are problems in using Porod's technique in that it is sometimes difficult to separate the required region at a few degrees θ from the diffuse intensity associated with a Bragg peak. Also, the theory does not apply to platelets or needles in which one dimension is much smaller than the others. Theoretically, it is still not certain if the sharp interface is a requirement of Porod's law. In the Al-Zn and Al-Ag systems, in which the zones should have diffuse interfaces, the law works for the first alloy (that is the data plotted in a certain way is a straight line as the theory says it should be) but not for the second. Quite recently, Tiboubar and Méring have extended Porod's work. Assuming particles of irregular shape, they have shown that it is possible to obtain not only the average sizes of particles and pores, but also information on the size distribution functions and from the data directly. They find that the Porod "law" works if the particles are not too angular. (The problem of a diffuse interface was not treated). Their results were checked with MgO powder.

Looking into the future, Guinier felt that the development of X-ray equipment for this work had perhaps gone far enough. High resolution instruments are needed only, for example, for biological molecules which are difficult to handle individually without damage in the electron microscope (and even here, as shall be mentioned later, it appears that electron diffraction from collections of molecules is easier to use than X-ray techniques). For large particles the more complex dynamical theory must be used anyway. The X-ray method is particularly suited for very small particles, 10 Å or so in size, for which the electron microscope has insufficient resolution. (Perhaps a classic case is the detection of the GP zones in Al-Cu with X-rays. Even with present-day techniques with the electron microscope, these are still practically impossible to see.)

Guinier closed his talk by mentioning some of the modern uses of small-angle scattering theory, light scattering from astronomical figures, MeV electrons scattered from nuclei, and neutron scattering from vortices in superconductors.

The work presented in the remaining papers can be discussed under three main areas, based on technique, i.e., X-ray studies, electron diffraction and special methods. Most of the papers were in fact concerned with technique rather than results of applications.

X-ray Methods - In a study of aging of Al-20 at pct Ag, Mrs. T. Healey and G. M. Leak (Manchester Univ.) used Dr. A. Franks' small-angle X-ray camera. (This is based on total reflection of X-rays to obtain a beam about 100-u in diameter.) Although no counting equipment has yet been specifically developed for this equipment, exposures are quite reasonable with films - a few hours at most - and the patterns are quite free of parasitic scattering, if some care is taken in placing the shielding.

The only difference in their results and those of Guinier and co-workers on this system is in terms of the kinetics. They found streaking before Guinier did. At about the same time, Prof. R. Nicholson (Manchester Univ.) observed platelets in an Al-16 wt pct Ag alloy (with the electron microscope).

Dr. M. Hart (Univ. of Bristol) discussed the Bonse-Hart technique of achieving a narrow direct beam without using slits, but by multiple scattering from perfect crystals. No new data over that which this group has been showing for the last year was presented, and it is still not certain that the method will provide enough intensity for, say, age-hardening systems. The direct beam intensity is the order of 10^7 cpm. During private discussions with Dr. Kratky (Siemens) he indicated that this is about 200 times the intensity that can be obtained with his camera for large particles, but that much larger intensities, perhaps 100 times, are possible with this unit with lower resolution, i.e., for smaller particles.

Electron Scattering Techniques - Dr. R.P. Ferrier (Cavendish Laboratories, Cambridge) presented a review of techniques for obtaining the small-angle scattering pattern in the electron microscope (see for example, R.P. Ferrier,

R.T. Murray, J. Roy. Microscopical Soc. 85 (pt. 3) pp. 323-335, June 1966). Regions down to a scattering angle of 10^{-6} radians or less than a second of arc can be observed by using the lenses in the scope to get a sharp beam, and to vary the effective optical path to distances of many meters (up to half a mile if necessary!). Ferrier also described some of his work at Cambridge using a phosphor photomultiplier. With a velocity selector, his group has separated the inelastic coherent and elastic coherent patterns, and the former is often predominant at very low angles by orders of magnitude. Some patience is needed (more, of course, at higher resolutions!) because the filament drifts for a few hours, due somewhat to air introduced through the airlock when the specimen is moved into position.

Some interesting applications of this technique were presented by others. R.H. Wade (C.E.N., Grenoble) showed that splitting of a diffraction spot by a domain wall in a ferromagnetic film could easily be detected, and the expected diffuse streaking between the spots could be seen. In another contribution he showed that shape transforms from dense nuclei in vapor deposited films could be observed and that useful information on the shape and distribution of nuclei could be obtained (see R.H. Wade, J. Silcox, Appl. Phys. Letters, 1966).

Dr. A. Keller (Bristol) reviewed some of the uses of this technique in studying crystalline polymers.

In another introductory lecture, Prof. R.E. Burger (Queen Elizabeth College, London) examined some of the theoretical attempts to calculate the electron scattering factor. Although the variations in the small-angle range (up to 10^{-3} radians) were only 8% (as compared to 4% for X-rays), many problems associated with these calculations remain concerned mainly with shell structure, exchange and correlation effects, lack of spherical symmetry, etc. Experimental determinations and theory are far apart at the moment.

Special Techniques - Some of the work at AERE, Harwell on detecting vacancy clusters with low-angle neutron scattering was presented. D.C.A. Taylor (University College of South Wales and Monmouthshire) showed some interesting optical transforms. Prof. A. Klug and Mr. D. de Rosier showed their technique of reconstructing the image from a biological unit with only portions of the diffraction pattern in an attempt to get rid of overlapping images and see only one side of the object. At the moment, many trials (and errors) seem to be the only way of selecting the correct spots.

Perhaps the most interesting contribution in this group of papers was that by D.C. Champeney and F.W.D. Woodhams (Univ. of East Anglia), in which they demonstrated how the small-angle pattern could be detected by using the Mössbauer effect. (A preliminary report appeared in Physics Letters, 20, No. 3 p. 275 (15 Feb. 1966), but more details were given at this meeting.) If a material which has fine particles or pores is placed between the source and absorber and rotated around an axis along the γ-ray's path, and if the rays are allowed to pass through the periphery of the spinning disc of the sample where velocities of 10^{5} cm/sec can be achieved easily at a few thousand rpm, then, for particles greater than 10^{-4} cm, the Mössbauer absorption is broadened. This occurs because the scattered γ-rays then pass through the absorber over a range of angles (the small-angle pattern) which leads to a Doppler shift in the resonance peak. The shift in energy is $\frac{\Delta E}{E} \approx \frac{V}{C}\theta$, where V is the transverse velocity of the scatterer. Thus, if the shape of the original absorption is removed by the usual deconvolution method, the remaining shape multiplied by $\frac{1}{\theta}$ is just the intensity distribution $I(\theta)$.

For smaller particles this cannot be done. Due to the rotation and the larger range of scattering, the total small-angle scattering is effectively removed from the Mössbauer pattern (into the background), so that by comparing the depths of the absorption with and without rotation, the total scattered intensity can be obtained. Such formulae as Warren's (Jour. App. Phys. 20, 96 (1948)) can then be used to estimate particle size: Woodhams and Chapeney have derived equations they feel are even more generally useful than Warren's. (J.B. COHEN)

METALLURGY DEPARTMENT, INSTITUTE OF SCIENCE AND TECHNOLOGY, UNIVERSITY OF MANCHESTER

The Faculty of Technology (or Institute of Science Technology) and the Faculty of Science of the University of Manchester exist as a Federation, much as do the numerous colleges of the University of London. The building complexes are separate, with those of

"Tech" being more in the center of town. Although the two are considered autonomous by the University Grants Committee, they share many facilities, and equipment to some degree. For example, Owen's Park, a residence (a bus ride from either of the two faculties on the outskirts of the city) is used by both. The MIT of the North here, has many fine new modern buildings in the otherwise grim surroundings of this industrious but depressing city where Dalton lived and worked most of his life.

There are a faculty club, dormitories, a fine student center and a classroom-lecturehall complex in addition to laboratories. Although the campus is continuing to expand, there is still not enough space for the students who wish to enter. Metallurgy occupies a floor in the original nineteenth century building. There are about 30 undergraduates each year majoring in metallurgy, and about 20 graduate students, two to three postdoctorates and 13 staff. As an example of their research, I will describe the work in the X-ray group.

Dr. W.D. Hoff works with Dr. W.J. Kitchingman primarily on computing techniques for indexing and refining lattice parameters, and Fourier analysis. (Their programs for these are available on request.)

Kitchingman is concerned with two main areas. He has succeeded in describing the sigma phase in terms of an assemblage of bcc units, which collapse across 112 planes and rotate slightly in a kind of synchro-shear. At the moment, he is studying the transformation to this phase, first with resistivity to delineate the various stages, and then with X-rays, to look for faulting. Accurate lattice parameters are being sought to examine the near neighbor distances.

He is also much involved in studies of line broadening. He recently has shown that the fault probabilities in Au and Ag base alloys are greatest at the phase boundary nearest the fcc phase, even though the electron/atom ratio may be lowest at this point in the single phase region. (See Brit. J. Appl. Phys. 17, 1039 (1966) and 16, 1311 (1965)).

At the moment he is working on deformation of solid specimens of Nb-Ti, Nb$_3$Sn, Nb-Zr, in an attempt to relate the effects of deformation on the critical current in these superconductors. He also plans to look at the deformation of CsCl structures. (J.B. COHEN)

MATHEMATICAL SCIENCES

ECONOMIST INTELLIGENCE UNIT REPORT SHAKES FLEET STREET

In its controversial, hard-hitting report on the efficiency of British newspapers (see The Guardian, 4 January 1967), the Economist Intelligence Unit (EIU) placed major emphasis on the lack of professionalism in newspaper management. Restrictive trade union practices were not seen as the fundamental weakness of the industry, but as "the outward symptoms of more serious and deep-rooted faults." The EIU team, headed by Mr. Geoffrey Browne, estimates an available manpower saving of 4000 men and a labor cost reduction of £4,875,000.

This timely report, requested by newspaper proprietors and trade unions, is indicative of the valuable output of one of England's most sophisticated users of advanced statistical mathematical analysis. The EIU is a UK consultancy organization operating on an international economic and business research scale. It was started in 1946 and is a subsidiary company of The Economist, but now operates separately and is completely independent of outside control.

EIU operates through two major sections, the Statistical Advisory Service and the Management Advisory Service. Marketing advisors and international specialists are also available.

During a recent visit by ONRL staff, Dr. William Buckland, Chairman of the Statistical Advisory Service, described the broad spectrum of projects ranging from detailed analysis and planning of the "new" cities to developing the statistics of an industry segment -- such as newspapers. Other subjects include National Health Service data, Social Security data, and traffic analysis.

The Statistical Advisory Service guides clients in the use of the most appropriate statistical techniques for the understanding and solution of their problems. These include: operations research, data collection using sampling techniques and statistical prediction, forecasting acceptability of purchased raw materials and components, stock control stores accommodation and use, quality control and inspection, life testing and reliability of products in service, and maintenance and renewal of equipment. Cooperation with clients extends to staff training at all levels in statistical methods

as well as advising on the use of computers and data processing equipment. For the most part, the techniques used are classic applications of statistical analysis -- the correction of data, often by sampling, and the projection of this history as the probable future.

The Management Advisory Service involves all phases of management, ranging from an immediate crisis solution to a long-range plan which can involve a complete reformulation of the company's future business. Also consultants are provided for assisting with specific areas such as sales, production, distribution and finance. The staff is oriented toward traditional Operation and Management with a strong quantitative bias.

In addition to the special studies for clients, the Unit publishes a series of highly regarded technical-economic analysis bulletins. Current quarterly publications of the Unit include: Quarterly Economic Reviews on over 120 countries; Motor Business, devoted to the problems of the international motor industry; Rubber Trends, review of production, markets, prices, etc.; Hard Fibres, review of production, markets, prices, etc.; Paper Bulletin, review of production, markets, prices, etc.; European Trends, the EEC and EFTA in perspective. Monthly publications include: Retail Business, British markets for consumer goods; and Marketing in Europe, European market for consumer goods.

The front-page headlines, Government reaction and subsequent action based on the EIU report on newspapers is indicative of the impact and acceptance that quality research using statistical and mathematical techniques can provide. Although not so deeply involved in sophisticated mathematical techniques as IBMOU in Rome, the EIU is another prime example of applied OR in action. Moreover, this application is being "bought." (P.D. Maycock and J. Heumann)

THE NATIONAL COMPUTING CENTRE BLOWS A FUSE!

During a recent meeting with ONSL representatives, Prof. Gordon Black, BSc., PhD., DIC, Director of the National Computing Centre (NCC), Quay House, Quay Street, Manchester, discussed the objectives, present status, and long-range plans of the Centre with rehearsed precision and clarity. He even admitted that the turning on of their ICT 1904 computer had knocked out the power for blocks around their facility. This minor quirk was soon mastered and the Centre took another important step toward viable reality.

The establishment of the NCC is just one of many actions taken by the Labour Government in its attempt to revitalize the British computing scene and indirectly, in the long term, to affect favorably the balance of payments. Initially, the Centre was financed by public funds. The inaugural council, representative of users, manufacturers, educators and local and national government, has been appointed by the Minister of Technology. The Centre is an independent, non-profit-making company, limited by guarantee. Fee-paying members are being accepted, and nominal service charges will be made.

The primary aims of the NCC are to assist in expanding the field of computer application, speeding up the preparatory work necessary before a computer can be used, and increasing the supply and quality of personnel trained in computer usage. Specific activities will include:

- Acting as a center of information about computing and data processing, and providing guidance to potential users; - Collecting and making available appropriate information about existing computer programs; - Developing and sponsoring generalized programs and systems designed to serve users having closely similar tasks; - Assisting in the provision of appropriate computer training, including training in systems analysis, programming principles, and appreciation courses for top management; - Promoting research into methods of programming and operating computers and into the influence of these on the design of computing systems; and - Developing new areas of computer application, sponsoring development in these areas.

At present, Black has a staff of 45. His goal for the end of 1969 is 250, of whom about 130 will be potential systems analysts with an Honours Degree or equivalent. Because of the limited supply of men knowledgeable about industrial use of computers, the Centre will accept individuals who are trained in computers and let them start in an "on the job" mode to obtain experience with industry. The Centre can pay salaries on the British AEC scale which is high enough to attract the best talent.

At the end of 1966, some 30,000 invitations to join the Centre were mailed. Applications are being received in numbers which please Black. For example, all major British banks have joined the Centre. Membership is open to any person, association or body engaged in or connected with the manufacture, sale or use of computers; those concerned in education or research with computers or their use; or those with commercial, scientific or professional interest in such use. The three classes of membership are:

		Annual Cost
Class A:	Manufacturers and/or Vendors of Computers	£5000
Class B:		
	a. Users of computers 1-1000 employees	100
	1001-10,000	250
	Over 10,000	500
	b. Computer consultants per 25 computer staff	100
	c. Local authorities Inhabitants less than 100,000	50
	100,001-750,000	100
	Over 750,000	150
	d. Educational Establishments (not maintained by local authorities)	100
Class C:	Other persons or bodies	50

Despite the dramatic interest in being a member of the Centre, there is no goal to make it self-supporting, since the Centre reasons that "you couldn't be doing a support to industry if you were making a profit." Be that as it may, the Centre will consider bringing in as much as 50% of its annual expenditure.

At present, the educational aspect of the Centre is in a very formative stage. One seminar on computers (four to five days) for board-level industrialists is scheduled. A working group is due to report in April on the manner in which the academic program should develop. Direct support will also be given to the new British management schools to enhance the training of computer technology to potential managers.

One important program is the establishment of the National Program Index. This will make available, on the widest possible basis, information about existing computer programs. Working parties are now scouring the country soliciting programs from all sources in virtually all disciplines.

Projections for the Centre include a vast computing complex of the order of magnitude of an IBM system 360-91 coupled to a 360-67. The time frame for a complex of this character is in the early 70's. To date, no decisions have been made as to the maker of the machine or its specifications. These needs are certainly being used as a big carrot for the British computer industry. In addition to the large center, a national mesh of smaller machines is not out of the question. However, for the time being, administrative offices of the NCC throughout UK will suffice. The first such field office has been set up in Scotland.

The NCC has been heralded with a blare of trumpets by the British press. Through the guidance of such an able scientist and administrator as Black, and with continued Ministry of Technology support, it would appear that the Centre is assured of success. (Paul Maycock and John Hamm)

1966 EUROPEAN MEETING OF STATISTICIANS

This Meeting, jointly sponsored by the Royal Statistical Society, the Institute of Mathematical Statistics, and the International Statistical Institute, was held at the Imperial College of Science and Technology, 5-10 September. Approximately 400 mathematicians and statisticians from the major western and eastern countries attended. The conference was very well organized, there being two sessions each day, each consisting of two or three related one-hour talks. The ten-minute contributed papers, which are less informative and usually of limited value to participants, were relegated to a single afternoon. The central themes around which the daily sessions were organized were: Foundations of Probability, Empirical Bayes Methods, Stochastic Processes and Statistical Analysis of Physical Problems, Some Approaches to Statistical Inference, Reliability Theory, Multivariate Analysis, Dynamic Programming, Sampling Inspection, Hypothesis Testing, and Process Control.

It is not feasible in the limited space available for this report to summarize the many interesting papers devoted to the topics listed above. I will therefore limit myself to a description of an invited address by Alfred Rényi of the Mathematical In-

stitute of the Hungarian Academy of Sciences, and to brief remarks on two other invited addresses.

Rényi's address, called "Statistics Based on Information Theory," was designed to stimulate interest among statisticians in applying concepts of information theory to problems of statistical inference. Rényi illustrated the possibilities in this direction by using the notion of the amount of information in one random variable about another random variable to study a simple estimation problem. His approach is to analyze statistical data by preparing an account of how much information concerning an unknown probability distribution is missing prior to the performance of an experiment, how much is gained or lost by the experiment, how much information is still missing after its performance, and so forth. This point of view enables the statistician to compare various available tests, decisions and so forth on a simple numerical scale.

The precise problem considered by Rényi is the following: Let θ be a parameter to be estimated, where θ is regarded as a discrete random variable. The a priori distribution of θ is denoted by

$$p_k = P\{\theta = \theta_k\}, \quad k = 1,2,\ldots,r.$$

The unconditional entropy of this distribution is given by Shannon's formula,

$$H(\theta) = \sum_{k=1}^{r} p_k \log_2 \frac{1}{p_k}.$$

This quantity is interpreted as the amount of missing information about θ when only its a priori probability distribution is known. Let ξ be a random vector of observations on θ and put

$$p_k(\xi) = P\{\theta = \theta_k \mid \xi\}.$$

The conditional entropy of θ given ξ is defined by the random variable

$$H(\theta \mid \xi) = \sum_{k=1}^{r} p_k(\xi) \log_2 \frac{1}{p_k(\xi)},$$

whose expectation, $E[H(\theta \mid \xi)]$, is interpreted as "the amount of missing information about θ after observing the sample ξ." It is then natural to define the amount of information about θ in the sample ξ as the difference

$$I(\theta, \xi) = H(\theta) - E[H(\theta \mid \xi)].$$

An estimate of θ based on ξ is a decision function $D(\xi)$ which takes values in the set $\theta_1, \ldots, \theta_r$. The "error" $\varepsilon(D)$, of a decision function D is the probability that the decision is wrong, i.e.,

$$\varepsilon = P\{D(\xi) \neq \theta\}.$$

The "standard decision" is defined by Rényi as the decision in favor of the hypothesis $\theta = \theta_k$ which has the largest conditional probability given the value of ξ. It is easy to see that no decision can have a smaller error than the standard decision.

One of Rényi's most interesting results is an estimate of the error of the standard decision in terms of the amount of missing information. If δ denotes the error of the standard decision and $M = E[H(\theta \mid \xi)]$ the amount of missing information, then

$$\delta \leq 1 - \frac{1}{r} M \tag{1}$$

Thus the error of the standard decision tends to zero as the amount of missing information tends to zero.

An upper bound for the amount of missing information in terms of the error of the standard decision is given by the inequality

$$M \leq C_r \sqrt{\delta} \tag{2}$$

where C_r is a positive constant depending only on r.

It follows from inequalities (1) and (2) that if $\xi_1, \xi_2, \ldots$ is an infinite sequence of observations, and if δ_n and M_n denote, respectively, the error of the standard decision and the amount of missing information based on the first n observations, then

$$\lim_{n \to \infty} \delta_n = 0$$

if and only if

$$\lim_{n \to \infty} M_n = 0.$$

Thus the information-theoretical point of view is consistent with the usual point of view of statistics.

An invited address by Yu.V. Linnik (Mathematical Inst., Leningrad) described some of the recent results of the Leningrad statisticians concerning

minimax tests, unbiased estimation, and similar tests. Another invited address, by M.S. Bartlett (University College, London) was a review of the spectral analysis of time series, and included a discussion of estimation of the spectral density function, testing for mixed spectra, eliminating a trend, cross-spectral analysis, and non-normality. Bartlett also described some recent extensions of spectral analysis to point and line processes.

Preprints of most of the talks were available at the meeting, and some may still be obtained by writing to the International Statistical Institute, 2 Oostduinlaan, The Hague, Netherlands. (Warren M. Hirsch, Courant Inst. of Mathematical Sciences, New York University, New York)

MECHANICS

LECTURE SERIES BY PROF. W.T. KOITER

A series of eight lectures on "The General Theory of Elastic Stability" was presented 3-5 January 1967 by Prof. W.T. Koiter, under the auspices of the Dept.of Civil Engineering, University College, London. The presence of this notable professor from the Technische Hogeschool, Delft, served to draw specialists from all over the UK. The formidable display on the blackboard was received by the audience with an enthusiasm usually found in typical freshman physics students. Professors of mechanics were seen furiously taking notes and remarking that they hoped that they did not evoke similar reactions from their students.

The series of lectures was actually an exposition and defense of the Energy Criterion of Stability, followed by examples in the field of Plates and Shells. Though Koiter referred only to his thesis[1] and two other references[2,3] in the course of his lectures, much of the material could also be found in a more recent paper[4]. Further references to his work can also be found in Reference 4. It could be remarked that even though some of Koiter's more recent work has been in the form of a summary of parts of his thesis, it would be invaluable to research workers and students alike if a translation into English were available.

Topics discussed during the sessions were: The energy criterion of elastic stability; Neutral equilibrium-validity of criterion of second variation as a necessary and sufficient condition for stability; Stability at the critical load; Post buckling behavior; Effect of imperfections; Application to plates and shells - Simplification for shallow buckling modes; The cylindrical shell under axial compression; The spherical shell under external pressure.

It was amusing that Koiter closed this remarkable series of lectures by reading a paragraph from a recently published series of volumes on nonlinear mechanics which very curtly dispensed with both the validity and veracity of past work and workers in the field of elastic stability. Koiter charitably commented that this must have been written in haste.

References

1. Koiter, W.T., "Over de stabiliteit van het elastisch evenwicht," Proefschrift Delft, H.J. Paris, Amsterdam (1945).
2. "Buckling and post-buckling behavior of a cylindrical panel under axial compression," NLL Report S-476, Amsterdam (1956).
3. "Elastic stability and post-buckling behavior," Proc. Symp. Nonlinear Problems, 257 (Univ. of Wisconsin Press, Madison, 1963).
4. Koiter, W.T., "The energy criterion of stability for continuous elastic bodies," Proc. of Koninkl. Nederl. Akademie van Wetenschappen, Amsterdam, Series B, 68, No. 4 (1965). (H.E. Williams)

MISCELLANEOUS

THE BRITISH EDUCATIONAL SYSTEM: SOME ABSOLUTE MAYBES

There are few subjects so fraught with emotional content as education. Few educational systems are attacked and defended as vigorously as that of Britain. Perhaps one's enemy should not write a book but rather be encouraged to draft a note on a controversial subject such as this. However, it is impossible to have a clear idea of the British social complex without some understanding of its educational system. This system predetermines much of what will be accomplished by Government, industry, management, the research community, etc. During the process of education, biases are built, class lines drawn, and capabilities defined. So this is submitted: generalities on a

subject which is actually kaleidoscopic, and while this may not be the world as it is, this is how we see it.

Throughout the British educational system, there are two basic kinds of schools: those operated at public expense and those funded privately.

Independent schools in England and Wales must be registered with the Department of Education and Science so that they can be shown to conform to minimum standards. Schools achieving certain higher standards may apply for recognition as "efficient"; independent schools so recognized contain about two-thirds of the private pupils. Similar requirements to so register schools also exist in Scotland and Northern Ireland. Fees at these independent schools, for tuition and boarding, range from between £300 - £550 a year, give or take a few pounds. However, a number of them offer scholarships. The largest and most important of the independent schools in Britain are known as "public schools," although not all those classed as public schools are independent (those which are not are most of the direct-grant schools). Public schools form only a minority of all independent schools. Note: These schools should not be confused with the State-supported public schools in Scotland.

The schools supported by private funds vary widely in quality, but those with the highest academic standing are as good as any in the world. Public schools for boys have made a notable contribution to English education and many of these date from at least the 16th century. The public school today is characterized by high staffing ratio and a high portion of pupils doing advanced work, and is often, although not always, a boarding school. The usual age of entry to the independent school for boys is 13, and the leaving age about 18. There are some girls' public schools modelled to a certain extent on those for boys.

Independent schools also include preparatory schools, many of which are boarding schools for boys aged from about 8 to 13, most of whom are intending to enter public schools; a few similar schools for girls; and wide range of other day and boarding schools covering every age group and grade of education and many educational types of method. Some of these schools are owned and managed, often under a trustee, by independent non-profit making bodies. Others are privately owned by proprietors for whom the running of the school involves a profit or at least a living.

In addition to this high standard, however, other considerations should be taken when observing the independent schools. Because most educators tend to perpetuate their own kind of learning and because for generations "the best minds" have been encouraged to pursue an education in the classics (i.e., Greek and Latin), this is the path the "top" students at these institutions are usually encouraged to follow.

The Government has stated that it intends to study how the independent schools may best be integrated into the State system of education. The social forces at work in the UK are such that the very existence of these privately financed schools is threatened. No doubt, before very much longer, these schools will be subject to greater and greater Government control. Selection of students will become even wider. Still, regardless of who attends these schools, they are considered by many as the breeding place of rigid class lines in Britain. Because of this, many people believe that such schools should cease to function.

The vast majority of students, over 90% of the school children, attend schools which are publicly financed. These students start at the primary level in schools which purport to be roughly equal, disregarding differences which may be due to neighborhood, teacher availability, etc.

There are some nursery schools which provide informal education and play facilities for children between 2 and 5 years old. At five, the age at which education becomes compulsory, children in England and Wales go to Infant Schools or departments until they are seven and then on to Junior Schools until the age of about eleven (the same in Northern Ireland, but twelve in Scotland).

In England and Northern Ireland, it is usual for boys and girls to be taught together in Primary Schools. In England and Wales less than half of the secondary schools are for boys or girls only, but in Northern Ireland over half are for single sexes. Mixed schools are more common in Wales than in Scotland, where all but a few city schools take both boys and girls. There are a few co-educational independent schools, including those with classes for small children, but the majority are for either boys or girls.

When these students reach about eleven years of age, they are given a selective examination (the "eleven plus"), which is perhaps, next to the occasion of their birth, the most important happening in their lives. This procedure can determine what the next phase of their education will be, and that decision begins to shape the rest of their lives.

The public or state system of education aims to give all children an education suited to their particular abilities. A change in the means by which this should be achieved in England and Wales was announced by the Government in November 1964, when it was stated that, as a matter of national policy, all secondary education would be reorganized gradually on a comprehensive basis.

"Comprehensive schools", which are not selective, will provide all types of secondary education for all or most all children in the district. This means they will offer a far wider range of courses than the schools they will replace, mainly "grammar schools" and the "secondary modern schools." Comprehensive schools can be organized in a number of ways. Some take the full secondary-school age range from 11 to 19; others, such as those found in parts of Leicestershire, are "two tier," with a junior high school for pupils between 11 and 14 and an upper school for pupils guaranteeing to stay there for at least two years.

The traditional Grammar Schools, for children who are successful in the selection procedures at the age of eleven (hence the term "eleven plus"), provide an academic education oriented toward university entrance. Secondary Modern Schools were originally designed to give a general education with practical bias. There are also a few Secondary Technical Schools offering a general education related to industry, commerce and agriculture. There are also schools providing all three or any two types of education, in separately organized streams. These are known as "multi-lateral" or "bi-lateral" schools. Most Grammar School pupils remain at school until they are sixteen and the rest leave between the ages of 17 and 19. Although the majority of Secondary Modern School pupils leave during the year in which they are fifteen, nearly one-fifth (17.5% in 1963-1964) stay on for another year or longer. In Comprehensive Schools, 16.7% of all pupils were over statutory school leaving age in January 1964. Some 62% of the 15-16 year old age group in England and Wales are in full-time schools or colleges for further education, but only 29% of the 16-17 year old age group still remain in schools of any kind. From these statistics, it is clear that a very large percentage of British school children leave school forever at the age of 15. About 85% of them have completed their education by the time they are 17. (Statistics vary and some often cited sources claim that 85% of the students leave school at15 years of age.)

The system of allotting children to different types of schools at the age of eleven and the selection method used have provoked much public discussion and critical thought. Also, it has become increasingly clear that many students want and benefit from a more academic type of course, and therefore many schools have been providing courses of the grammar and secondary type. When the Government announced in 1964 that it favored a comprehensive policy, many local authorities had already implemented or were already planning to introduce comprehensive systems.

Scottish secondary schools fall into two main categories, those providing courses extending normally to three years, generally called Junior Secondary Schools, and those providing courses of four to five years, known as Senior Secondary Schools. In each type of school courses are intended to provide general education. They are differentiated in character to suit the varying needs and abilities of the pupil and include literary and commercial boys', technical, domestic and rural courses. About 45% of the schools are Junior Secondary and 55% are Senior Secondary; of the latter about 75% are comprehensive, a type traditional in Scotland. Over one-third of all the pupils go on to senior secondary courses on reaching secondary school age. Pupils are transferred to the different types of secondary school on the basis of teachers' estimates of attainment, intelligence tests, achievement tests, and due regard to the wishes of the parents. There is a provision for an appeal to the Secretary of State for Scotland in the event of a dispute between the education authority and the parent and also for the reconsideration of original allocations at a later date.

In Northern Ireland there are Grammar Schools, Secondary (intermediate) Schools, which are the equivalent of

the Secondary Modern Schools in England and Wales, and Technical Intermediate Schools, which offer the same facilities as the Secondary Technical Schools in England and Wales. Some changes of organization in educational development in Northern Ireland are likely as the result of the 1964 White Paper.

There is no national examination in England or Wales upon the completion of Secondary School, but these pupils (and candidates not attending school) may take the General Certificate in Education (GCE) or the Certificate of Secondary Education (CSE). The GCE, which is on a single subject, and not a group subject basis (that is, no subject is obligatory and the individual subjects may be taken at different times), is conducted at "ordinary" and "advanded" levels. These are more familiarly known as the "O" and "A" level. Most of the candidates for the "O" level are about 16 years of age, although many take it earlier at the discretion of the head teacher. Most direct-grant and independent school pupils and an increasing number from other secondary schools take the Ordinary examination, and passes in the various subjects are widely accepted for entry courses for vocational training. The advanced examination is at the university entrance level, supplemented since 1963 by special papers to help the university authorities in selecting students, and is accepted also for the purposes of entry into many forms of professional training.

The CSE, instituted in 1965, is designed for pupils who have completed five years of secondary education, but who are not taking GCE; it is also on a single subject basis and is controlled by teachers who are serving in the schools providing candidates. The highest grade of pass in the CSE is intended to be of the same standard as the pass in the GCE "O" level.

In Scotland, the Senior Secondary Schools lead to examinations conducted by the Scottish Certificate of Education Board. School pupils in the fourth year of secondary courses sit for examination at sixteen years for the award of passes on the "Ordinary" grade for Scottish Certificate of Education, and pupils in their fifth year can obtain passes on the "Higher" grade of the Scottish Certificate of Education. Examinations at both grades are open to candidates who have left school.

In Northern Ireland, candidates may take the Junior Certificate Examination at about the age of 14, and the Northern Ireland General Certificate of Education at about the age of 17.

In England and Wales, local education authorities maintain about 500 colleges which provide technical and commercial courses at every level, and a number of GCE courses. These and the entire system for higher education will be discussed in the February issue of ESN. (J.W. HEMANN)

PHYSICAL SCIENCES

THE INTERNATIONAL BOAT SHOW

The International Boat Show was held at Earls Court, London, 4-14 January. One has to attend this show to comprehend the extent of boating enthusiasm in this country. Sailboats seemed to outnumber power boats. Special features were: English Rose III and her crew, Ridgway and Blyth, who rowed from Boston to Aran Isle in 92 days last summer; a demonstration of helicopter rescue by the RAF Coastal Command; the Lady Helsman catamaran that won the Little America's Cup; and a figurehead sculptor carving a 7-ft mermaid. In the unique craft category is a waterborne motorcycle on two hydrofoils that is 9 ft long and capable of 30 mph; and the Miniscaphe, a two-man submersible that travels only a few feet below the surface.

I was particularly interested in the number of echo sounders available for small boat owners. On display were three of the light-indicating type, five of the meter-indicating type, and three graphic recorders. The light-indicating type, ranging in price from £23 to £52 (£ = $2.80), are produced by at least five manufacturers. One unit, weighing 3½ lbs, with a self-contained battery has two ranges, 0-60 ft and 0-60 fathoms, accuracy 3% and sells for £25. A meter-indicating sounder with the same ranges and accuracy has an audible depth alarm adjustable for depths between 4 and 10 ft. It sells for £36. There are also at least five manufacturers of the meter-indicating sounders. Of the three graphic echo sounders displayed, one priced at £60, has three ranges, 0-60, 60-120 and 120-180 ft. It uses two transducers and operates at 143 kHz. All but one of the sounders uses ceramic

transducers operating above 100 kHz; one graphic recorder uses a magnetostrictive transducer operating at 30 kHz. (W.J. TROTT)

NEWS & NOTES

Central Advisory Council for Science and Technology - The members of a new Central Advisory Council for Science and Technology, formed to advise the British Government on the most effective national strategy for the use and development of the country's scientific and technological resources, have been named by the Prime Minister. Under the chairmanship of Sir Solly Zuckerman, FRS (Chief Scientific Adviser to the Government), they are: Sir Eric Ashby (Master of Clare College, Cambridge), Prof. P.M.S. Blackett (President of the Royal Society), Dr. A.H. Cottrell (Chief Adviser (Studies) to the Secretary of State for Defence), Mr. Frank Cousins (General Secretary, Transport and General Workers Union, late Minister of Technology), Dr. F.S. Dainton (Vice-Chancellor, Nottingham Univ.), Dr. F.R. Jones (Managing Director of Mullard Ltd.), Sir Harrie Massey (Quain Professor of Physics, University College, London), Prof. A. Brian Pippard (John Humphrey Plummer Professor of Physics, Cambridge Univ.), Sir Hugh Tett (Chairman, Esso Petroleum Company), Prof. Bruce R. Williams (Stanley Jones Professor of Political Economy, Manchester Univ.), and Mr. R.D. Young (Deputy Chairman, Alfred Herbert, Coventry).

A NATO Advanced Study Institute on Stochastic Problems in Underwater Sound Propagation has been organized. The Institute, sponsored by the Italian Navy, will be held in Lerici (La Spezia) 18-29 September 1967. The scientific director will be Prof. Maurizio Federici; the local organisation will be provided by USEA (Ufficio Studi Elettro Acustici) under the direction of Prof. Giuseppe Pazienza. USEA is a contract laboratory operated by Finmeccanica for the Italian Navy. Twenty-five lectures have been announced under four subject areas: Phenomena of sound propagation in a random medium; Structure of signal noise and reverberation; Detection problems; and Oceanography. Papers will cover shallow-water propagation, spatial structure, fluctuations and coherence, signal processing, and cavitation. Lecturers are from Italy, France, Germany, US, Canada, UK and Japan. Information requests should be addressed to Prof. Maurizio Federici, USEA, Via P. Mantegazza nr. 23, San Terenzo (La Spezia), Italy. (W.J. TROTT)

A Hovercraft Unit is to be established at the National Physical Laboratory, Teddington. It will take over the work presently being done by the Hovercraft Technical Group at Hythe, near Southampton, and will deal with all forms of hovercraft and other applications of the air-cushion principle, including hovertrains. Hovercraft Development Ltd. will not come within this new unit and remains a subsidiary of the National Research Development Corporation, with Christopher Cockerell, the inventor, as consultant.

The National Electronics Research Council, established in 1964 to coordinate pure and applied research in electronics, is to change its function. It will be re-named the National Electronics Council and will be responsible for advising the British Government on the impact and the application of electronics in national life. If the need to promote research or encourage some other activity is seen to exist, the new body will be empowered to take the initiative either directly with the Ministry of Technology or with other organizations in the electronics field. Earl Mountbatten will continue as Chairman.

Described as "only as big as a tin can", a French invention has been developed to produce drinking water from the sea. It was designed by Société de Recherches Techniques et Industrielles, 111 rue de la Boëtie, Paris VIII, a company in which CSF (Compagnie Générale de Télégraphie sans Fil) has an interest. The principle of the invention is that of reverse osmosis in which saline water is forced through a semi-permeable membrane at high pressure, leaving its salt content on one side. A considerable amount of research is in progress on this technique at present because of the great simplicity it offers and the possibility that even small plants based on it will be economic to run.

The Wolfson Foundation has made a grant of £10,000 ($ = $2.80) to the Univ. of Exeter to provide an Zoological Laboratory for the Dept. of Zoology. This new laboratory will enable

the Department to extend its field of research in ecology and animal behavior, with particular reference to post-graduate studies.

Grants totaling £222,000 from London Univ. and the Ministry of Health have been made for the purchase of premises in Foley Street, London, near the Middlesex Hospital Medical School. They will house new and expanded departments of the Bland-Sutton Institute of Pathology, under the direction of Prof. G.W.A. Dick. New laboratories for hematology, virology, bacteriology, and experimental pathology will be built as early as possible, and the plan provides for data processing and central counting units.

A new Institute of Computer Sciences and Cybernetics, with headquarters in London, is being planned. It will be concerned with programming, systems analysis, information storage and retrieval - everything except hardware. Dr. J. Rose, Principal of Blackburn College of Technology and Design, is chairman of the organizing committee.

The following news items have been brought to our attention by colleagues in Scandinavia.

The formal opening of the European Space Research Organisation (ESRO) Sounding Rocket Launching Base (ESRANGE) was held on 24 Sept. ESRANGE is located 45 km east of Kiruna, in northern Sweden. (Svenska Dagbladet/Dagens Nyheter, 25 Sept 1966, Sweden)

Lund University's new observatory located at Romeleåsen, 18 km from Lund, was opened recently. Construction of the observatory was started in Feb 1965 and has cost more than Swedish Kr 1 million (Skr 1 = $0.193). At 145 m above sea level, the observatory is the highest in Sweden. It has a mirror telescope, the mirror of which has a diameter of 61 cm. (Svenska Dagbladet, 28 Sept and 3 Oct 1966; Dagens Nyheter, 1 and 2 Oct 1966, Sweden)

Prof. Jöran Rasmberg will serve as assistant director of the European South Observatory presently under construction on La Silla mountain in Chile. It has been reported that Rasmberg last summer declined the top post at Stockholm observatory in Saltsjöbaden in favor of the assignment in Chile. The Stockholm post was offered to him after the death of the observatory's former director, Prof. Bertil Lindblad. (Svenska Dagbladet, 3 Oct 1966, Sweden)

A "radiation factory" which may become very important for the fishing industry is being constructed in Herstedöster, outside Copenhagen. It is said to be the largest one of its kind in the Nordic countries, and it will be put into use next year. Detailed information about the project can be found in the Danish Atomic Commission's annual report. Fresh fish which are irradiated can be kept twice as long as usual. (Svenska Dagbladet, 26 Oct 1966, Sweden)

The Danish AEC sub-committee on nuclear power production has submitted a report to the Minister of Education in which it is recommended that a project for a Danish nuclear power plant be prepared before 1970. The committee envisions the construction of eight to ten nuclear power units in Denmark within the next 15 years. The committee reports on the initial research begun by Danish industries such as the Burmeister & Wain and Helsingör shipyards, and expects that Danish industries may contribute significantly to the eventual construction of Danish power reactors. (Borsen, 9 Sept 1966, Denmark)

The official opening of a new Danish university was celebrated in Odense on 15 Sept. The university starts modestly in premises rented from the Odense Technical College. The faculty comprises 12 professors and some 20 research and educational assistants. 180 students are enrolled. The president is Prof. Mogens Brøndsted. (All papers, 16 Sept 1966, Denmark)

At ceremonies attended by Finland's President Kekkonen and the chief of the Finnish industrial firm, Outokumpu Oy, a new Outokumpu research facility was opened at Espo. The facility has 4130 m² of floorspace, will employ a staff of 43, and will support the company's activities in the field of manufacturing instruments and machinery for the mining industry.

The Swedish Royal Academy of Sciences has appointed Assistant Prof. Per Olof Lindblad as head of the Stockholm Observatory, beginning 7 Nov 1966. Lindblad has been at the Observatory since 1951 and has made study and research trips to the US, the Netherlands, Germany, Italy, and the Soviet Union. His most important work has been in stellar dynamics and radio astronomy. (Svenska Dagbladet, 27 Oct 1966, Sweden)

Dr. Dennis Taylor, Head of UNESCO Mission, Faculty of Engineering, University College, Nairobi, has been appointed to the new Chair of Electronic Science and Telecommunications in the School of Electrical Engineering, Univ. of Strathclyde, as from 1 April 1967.

Mr. L.F. Rutherford has been appointed Secretary of the Computer Board for universities and research councils. He previously served in the Computer Advisory Service of the Ministry of Technology.

Dr. H.G. Hopkins, formerly at the Royal Armament Research and Development Establishment, is now Professor of Mathematics at the Univ. of Manchester Institute of Science and Technology.

Dr. L. Hough, Reader in Bristol Univ., has been appointed to the Chair of Chemistry, Queen Elizabeth College, London Univ.

Dr. Peter Alexander has been appointed Professor of Radiobiology at the Institute of Cancer Research, Royal Cancer Hospital, London.

Dr. D.F. Cheesman has been appointed Professor of Biochemistry at Bedford College, London Univ.

Dr. D.R. Hughes has been appointed Professor of Mathematics at Westfield College, London Univ.

Dr. J.F. McOmie has been appointed Professor of Organic Chemistry at Chelsea College of Science and Technology, London.

Mr. J.G. Truscott has been appointed Director, Electronics Production (Telecommunications) in the Ministry of Aviation, in succession to Mr. N.R. Reid, who has retired from the public service.

Prof. V.A. Crawford Stewart, presently Professor of Economics at Keele Univ., has been appointed Vice-Chancellor of Keele Univ., in succession to Dr. Harold Taylor, who retires this year.

Dr. M.F. Lamport has joined the staff of the Department of Physical Metallurgy, Birmingham Univ., as a lecturer.

Dr. G. Meyrick, Metallurgy Division, National Physical Laboratory, Teddington, will leave this spring to join the staff at Ohio State Univ. He has been to the US once before, working at Carnegie Tech. His specialty is field-ion microscopy.

Dr. A. Preisinger, with National Physical Laboratory's Metallurgy Division these last 18 months (after 4½ years at US Steel's Research Center) will this spring become senior Lecturer in the Metallurgy Dept. of Manchester Univ.'s School of Applied Science and Technology.

Prof. C.F.A. Pantin, FRS, died on 7 Jan at the age of 67. He was Professor of Zoology at Cambridge Univ. from 1959 to 1966. His research was on various invertebrates and while on the staff of the Marine Biological Association Laboratory at Plymouth in the twenties he worked on the locomotion of amoeba. His work on sea-anemones was particularly noteworthy and he recently studied land nemertines.

Technical Reports of ONRL

The following report has recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York 09510.

ONRL-1-67 Polarization Characteristics of Radar Echoes by M.W. Long

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R&D
(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
OFFICE OF NAVAL RESEARCH
BRANCH OFFICE LONDON, ENGLAND

2a. REPORT SECURITY CLASSIFICATION

2b. GROUP

3. REPORT TITLE
EUROPEAN SCIENTIFIC NOTES 21-1

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
N.A.

5. AUTHOR(S) (Last name, first name, initial)
Rasmussen, J.E. and Hewitson, Victoria, ed.

6. REPORT DATE
31 January 1967

7a. TOTAL NO. OF PAGES
21

7b. NO. OF REFS

8a. CONTRACT OR GRANT NO.
N.A.

b. PROJECT NO.
N.A.

c.

d.

9a. ORIGINATOR'S REPORT NUMBER(S)
ESN-21-1

9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
N.A. CO

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510

11. SUPPLEMENTARY NOTES
N.A.

12. SPONSORING MILITARY ACTIVITY
N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473

UNCLASSIFIED
Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Aerospace Biological Sciences Earth Sciences Material Sciences Mathematical Sciences Mechanics Physical Sciences						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization (*corporate author*) issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers (either by the originator or by the sponsor), also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring (paying for) the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as (TS), (S), (C), or (U).

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

Security Classification

AD NUMBER: AD0808674

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 31 Dec 1966. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

No. 20-12

31 December 1966

Distributed by the
Office of Naval Research Branch Office,
London

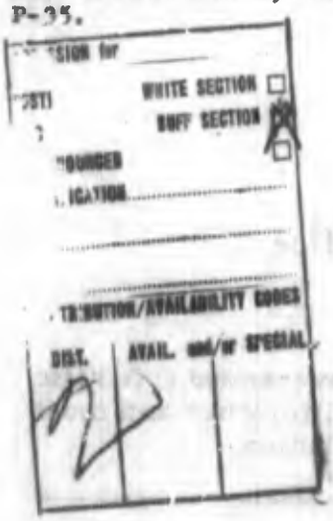
OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

Edited by J.E. Rasmussen and Victoria S. Hewitson

31 December 1966 Vol. 20 No. 12

European Scientific Notes is Group II Newsletter type Class B periodical prepared and distributed by the Office of Naval Research London in accordance with NAVEXOS P-35.



(b) (6)

C. T. FROSCHER
Captain, U.S.Navy
Commanding Officer

MATERIALS SCIENCES

Materials Activity in the Chemical Engineering Department, Imperial College of Science & Technology, London University

The activities of this Department, directed by Prof. A. Ubbelohde, cover a broad spectrum: molecular technology, nuclear engineering, combustion, fluid dynamics, high pressure work, and solid state studies. It is the last area, which is Ubbelohde's main interest, that I shall discuss.

There are 85 undergraduate students in the three-year program, and 120 graduate students. Of these, a dozen or so are working in the area of materials, and about four PhD's are awarded annually in this field. The work is directed by Ubbelohde through three senior staff members. Ubbelohde himself believes strongly in inter-disciplinary training, and the research groups often are composed of persons trained in a variety of fields.

Dr. A.E.B. Presland, lecturer, is just beginning work on the physics of surfaces, after many years with Dr. D.W. Pashley at Tube Investments, Ltd. His main experimental tools are three electron microscopes (a Siemens I, a Metropolitan Vickers unit converted for use solely as a diffraction instrument, and a new JEM 7 unit including the attachments for scanning). Presland's research is in the following five areas:

(1) He is starting to examine the effects of alloy additions on dislocation substructure in Fe.

(2) Using the excellent synthetic graphite (prepared in this group by high temperature-pressure treatment), he is producing amorphous films and studying their graphitization.

(3) Particular attention is being given to the study of the microstructure of the polymeric form of sulfur, because it is a polymer of only one element. Thin films are prepared by melting sulfur, quenching and drawing it. Two kinds of fibrils have been observed, one 50 Å in diameter, the other 250 Å (see Nature 208 (1965), p. 1088). Additions of both P (which forms cross links) and I_2 (which adds at chain ends) suppress the formation of the fibrils, although the "why" is not clear. Polymeric sulfur can also be prepared by photochemical methods, with the obvious advantage that no orientation due to drawing will occur. Sulfur dissolved in CCl_4 polymerizes when irradiated with ultraviolet rays. The resultant suspension can then be sprayed on a carbon support film, for microscopy. Once again, both types of fibrils are formed, but the finer ones are seen to emanate from the tips of the coarser fibrils.

Using a technique developed at Cambridge, they hope to make a very thorough study of molecular weight distributions and the effects of I_2 on this, and to learn more about the reasons for the organization into fibrils. This technique consists of polymerizing sulfur photochemically in a mixture of good and poor solvents; the former must have a higher vapor pressure. As it evaporates, the polymeric sulfur precipitates in the form of spheres. The sizes of such spheres can be measured on the microscope, and the molecular weight estimated, assuming close packing in the spheres.

Some attempts will also be made to use light scattering methods.

(4) With an American PhD candidate from A.D. Little Co., Presland is examining the conditions of temperature and pressure for formation of laminar lubricant (such as WS_2) from liquid lubricants containing W. (This work is directly associated with a commercial product, but the firm that makes it is unfortunately unwilling so far to provide more support than free samples!)

(5) Grain growth reduces the surface area of catalyst materials, thereby reducing their efficiency. This might be as important as "poisons," and Presland is investigating grain growth by depositing films of Pt, Pd on carbon supports in order to watch their coagulation and coarsening in the electron microscope.

Dr. H. Wilman, a Reader, is working in three main areas:

(1) He is studying friction and wear, through experiments which are beautifully simple! A large cube under a load is rubbed on emery paper. (Certain precautions are needed such as: use of a course enough particle size to avoid clogging the emery; always rubbing on a fresh region of emery; and taking of data after a few "rubs" to be sure that it corresponds to a fully deformed surface layer of the specimen.) Friction is obtained from the ratio of force to load, and wear from the weight loss. If the load is adjusted to provide a constant depth of penetration of the abrasive into the metal, a straight-line relation exists between friction or wear and hardness. (The data includes

work on alloys. Micro hardness is used, indenting the abraded layer.) The decrease in wear and friction with increasing hardness is much more pronounced for fcc materials than for hexagonal systems. The texture produced by the wear is similar to the rolling texture, but opposite to the force by an amount roughly proportional to the friction. Age hardenable alloys are being studied now.

(2) Wilman is continuing his studies on electrodepositing single crystals. Up to 20,000 Å can be obtained with Ag deposited from $AgNO_3$ solutions. Much higher current densities were possible than in his work on Cu deposited from $CuSO_4$ solutions.

(3) He is studying the vapor deposition of Sn and Ag, and the effects of pressure, thickness, etc., on texture.

Finally, Wilman is still interested in his early love, "circular slip," but he is not now working on it. (This is a phenomenon in which slip occurs in a circular fashion under torsion, rather than in a specific direction. For some reason this is not given much attention these days, although it could be very important in the formation of kinks and deformation bands.)

Dr. G.S. Parry, Lecturer, is continuing his study of intercalation compounds of graphite; such groups as $SO_4^=$, NO_3^-, K, Rb, etc., enter between basal planes, and the graphite layers expand and shift. (Proc. Roy. Soc. A 291, 324 (1966)).

Stacking sequences such as A|A|A, A|AB|BC|CA|A, etc., occur (where the line represents the intercalating material); dislocations must be involved. Below about -20°C, long-range order sets in among the ions in the penetrated layers, and between the interrelated layers far apart. There is a wealth of information yet to be obtained with these materials, on the nature of ordering, long-range interactions, effect of periodicity or diffraction, etc.,Here again, their very good graphite is used as starting material, as they have found that compound formation is more reproducible with this material than with natural graphite. (J.B. Cohen)

Materials Research,Central Electricity Generating Board

The nationalized power industry is separated into five generating districts and 12 distribution areas. There are four research laboratories for the industry; one at Leatherhead, Surrey, concerned with conventional generating equipment, pipes, valves, turbines, etc.; another at Berkeley (near Bristol) where the main concern is nuclear reactor technology; the Marchwood Engineering Laboratories, near Southampton, which does large-scale experimental work involving large rigs and pilot plants; and the fourth, a new one just beginning operation at Capenhurst (near Liverpool and Chester), which will carry on research concerned with the distribution end of the business.

The laboratories in Surrey are concentrated in two buildings. One is quite new and modern in the usual "glassy" style, including a large pool on which "floats" an auditorium. (The water is actually used in mockups of cooling towers.) In this building, offices and small labs are on the outer walls. A large central core is used for models of pressure vessels, low-velocity wind tunnel experiments concerning the stacks which occasionally collapse over here, MHD experiments, and other large scale research. Metallurgy, however, is housed in an older building a few blocks away. The organization of this second laboratory, about 100 people, is sketched in Fig.1. The solid state group in the new building will be incorporated into this division. This group is working on MHD, and liquid semiconductors for possible use as temperature sensors in a reactor (as they are not affected, as are solid semiconductors, by radiation damage), and finally on superconducting materials. They have just developed a superconducting wire composite that will enable larger windings without troubles with "hot spots."

In metallurgy, the areas of interest, all concerned with steels, are as follows: fracture, thermal and stress fatigue, creep, oxidation, failure of the protective magnetite layer in boilers, precipitation, and high temperature strength. In addition, there is work going on on stabilized ZrO_2 for MHD generators, with particular interest in increasing electronic conductivity below 1400°C.

The labs are moderately well equipped with an electron microscope, two diffractometers, and three film units. One novel feature is a scanning electron microscope. Most of the remaining equipment is the usual.

Only the work in Dr. R.K. Ham's group will be described. (That of

CEGB - MATERIALS DIVISION, LEATHERHEAD, SURREY

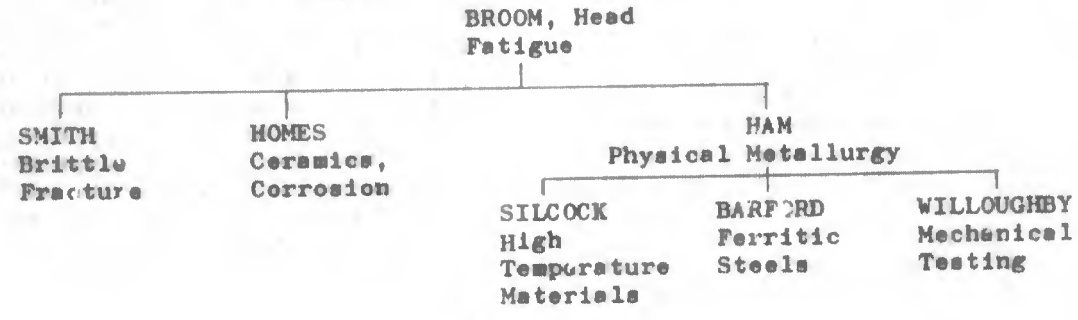


Fig. 1

Smith's section is well known, and papers have appeared recently in Acta Met.) Eighteen 12-1 austenitic steels have been causing some troubles in reactors of late, therefore some fundamental work on precipitation in these alloys has been started by Miss J. Silcock.

Niobium carbide precipitates on Frank partial dislocations, which appear to emanate as loops from dislocations decorated by precipitates. Because the carbide has a larger volume than the matrix, the precipitate nucleates at the edge of the partial and then the two grow simultaneously. The process appears to be diffusion controlled, but the activation energy is lower at high temperatures than at low temperatures. Work with VC and TaC has been started in an attempt to sort out whether this effect is due to a change in the rate controlling process from diffusion in the carbide to diffusion in the matrix. TaC forms as cubes, VC as plates. The group has been involved with Prof. P. Hirsch's group in calculating the peculiar strain contrast near the edge of the Frank partials seen in these alloys.

It has also been observed that by decreasing the stacking fault energy of the matrix, the extent of the grain-boundary region free of precipitate decreases.

In a 25 Ni - 15 Cr (austenitic) steel with 2.5% T_1, 0.25% Al, the observed properties due to precipitation of γ' are indicated in Fig. 2. The yield strength is affected most early in the aging process by the necessity to cut <u>through</u> precipitates. Later, in aging, loops form around precipitate and work hardening increases drastically. This is the usual behavior expected as precipitates grow. However, with a high nickel alloy, where there is little difference in the lattice parameter of γ' and the matrix, there is little work hardening, even though loops are observed to form. The group believes this is because the lower coherency strains enable a second dislocation to force the loop through the precipitate.

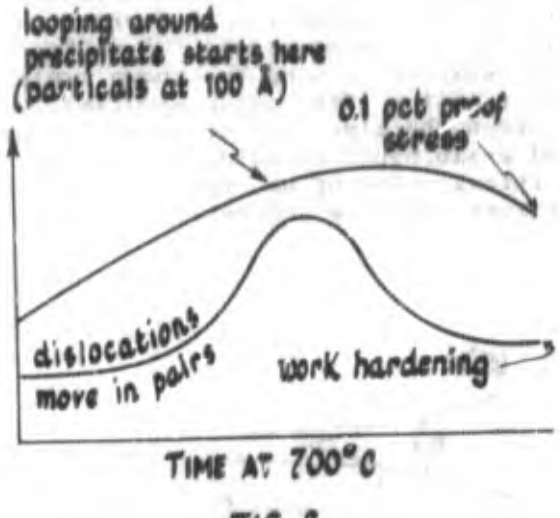


FIG. 2.

Dilatometric studies of the kinetics of precipitation of Fe-0.1 C with 0.5 V or 1.3 pct Mo are under way. For short times, the precipitate volume fraction varies as $t^{2/3}$, whereas at longer times, the exponent is close to unity. This checks with the observed morphology. At short times the precipitate forms on dislocation (presumably due to the strain field); but at longer times, when the dislocations are "consumed" or covered completely, the precipitate is growing as a cylinder. Less Mo_2C forms than VC, and softening due to coarsening starts at a lower volume fraction of precipitate in the Mo containing steel.

In Al-Cu alloys, it has been

found that at the same aging temperature θ' forms at low angle boundaries, θ at high angle ones, except for certain special boundaries, where a (100) face of one grain is at the boundary. In this case θ' forms at the boundary and grows into its neighbor, following Aaronson's suggestions. In simple tilt boundaries, the precipitate forms with the direction of maximum dilation perpendicular to the boundary, i.e., along the Burger's vectors of the dislocation array. (This is similar to the way these precipitates form on dislocations, as first pointed out by Nicholson.) All possible orientations occur in twist boundaries.

An interesting study is being made on failure in an Al-10 at pct Zn alloy. Because there is a precipitate free zone at grain boundaries whose width can be varied by heat treatment, slip can be confined to the vicinity of the grain boundary. Referring to Fig. 3, a forming crack, "C" vs "na" was measured. Using the known empirical relation (from creep studies) between the time rate of change of na and grain boundary sliding, and the critical value of na, the time to failure could be accurately predicted.

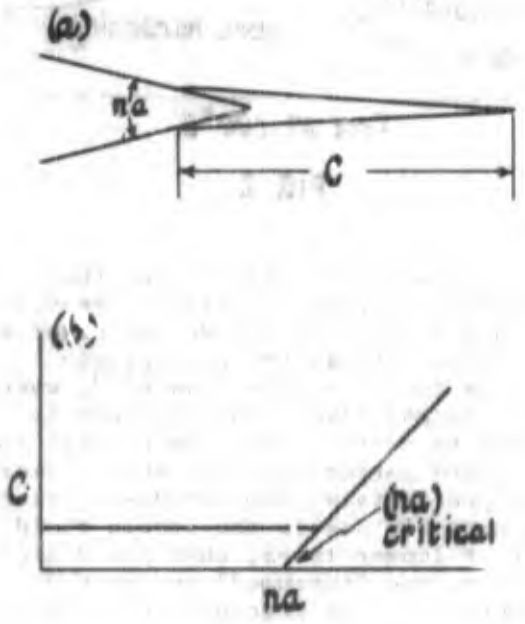


FIG. 3.

Keh and Leslie, at U.S. Steel, found enhanced dislocation density in the region of jerky flow and increased strength of mild steel. This was presumably due to pinning of generated dislocations by simultaneous carbide formation. But the group here has found that beyond the temperature for this phenomenon, where the strength is still higher than it is on testing at room temperature, there are no excess dislocations. (J.B. Cohen)

MATHEMATICAL SCIENCES

Operations Research in Italy

The status of operations research (OR) in Europe has not been reported by this Office for some time; however, an attempt now is being made to cover the military, commercial and academic centers of excellence. The information below on some OR in Italy is the first of a series of notes on the subject. Ultimately, ONRL Technical Reports will be issued on the subject and an extensive bibliography of OR practitioners in Europe will be assembled.

Statistics and Operational Research Section, Ministry of the Navy, Rome - The Statistics and Operational Research Branch (Ufficio Statistica Meccanografia e Ricerca Operativa) of the Italian Navy is headed by ADM Bruno Mazzurini, a trained statistician. He reports to the Assistant Navy Director (comparable to Vice Chief of Naval Operations). His office also reports to the Ufficio Statistica Ricerca Operativa e Automazione (Office of Statistics, Operations Research and Automation) which comes under the Technical and Scientific Council of the Defense General Staff. This latter office has a direct information link with the Italian Central Institute of Statistics.

Under Mazzurini there are four sections: The first is charged with receiving and aggregating the logistics reports of all operational units of the Italian Navy. It must be emphasized that this section is for information storage only. It initiates no studies and requests no specific data. It does report in resume when asked by competent authority.

A second section is charged with the collection and collation of all cost data from the various operational units of the Italian Navy. Again, no studies are performed nor are the cost data analyzed.

The most interesting group is the Analysis and Operations Research Section, headed by CAPT Vascello W. Bisi. Bisi is a highly-qualified practitioner who holds a Doctor's degree in Science as a statistician and actuary. He is also Prof. of Statistics, Dept. of Operations Research, Univ. of Rome, and teaches a course in Military Operations Research. He is Italy's member on the NATO Advisory Panel on Operations Research.

The Analysis and Operations Research Section (AOR) is now four years old, and in addition to Bisi employs a number of civilian consultants, mostly university professors. The group has completed 80 studies of problems stated by the Italian General Staff (Navy). None has involved a computer, although computers are available for the group's use at the Central Institute of Statistics. They will shortly have their own IBM-360 in operation.

Studies conducted have included analysis of mine sweeping operations. Some have been accepted and implemented by NATO. Three recent studies of mine sweeping operations were accepted by the NATO Technical Panel.

The AOR has also studied ASW problems: optimum screen placement and efficient barrier patrols (using surface ships and aircraft but not submarines). From this area of study, two papers were presented at the LaSpezia Symposium several years ago. It is planned to conduct ASW studies employing helicopters.

Completed studies have mostly dealt with tactics, but the group has analyzed logistics flow (but not control). They have studied radar interception capabilities and have done considerable work on weapons performance characteristics and the selection of weapons from a given current inventory. The group has also been involved in the analysis of new weapons.

In October 1966, the AOR began a study of missile employment on ships. They will generate Navy doctrine on use of missiles by ships. For example, they are exploring the optimal distribution of launchings at multiple targets given a single launcher and two directors. Next they will study naval formation in conjunction with missile ships, e.g., in convoy.

The group will continue to produce personnel studies for each of the services and for the Defense General Staff; these are primarily distribution studies.

The next major effort will be to set up simulation studies and war games. (Any US assistance on methodology will be most welcome.) They will be dual programs with the machine containing the parameters (optimum threat) and the gamers (naval officers) playing against each other, not the machine. In the simulation studies the operators will be civilian scientists. The gaming will be primarily for the development of tactics for naval air battles with missiles. The simulation will be primarily to test found tactics and improve selection from a current inventory of systems. The group is beginning liaison with the services in war gaming. Other services have no war gaming facilities, but the Defense Office of Statistics, Operations Research and Automation plans to develop such facilities and to conduct joint war games.

Under Mazzurini's Navy office, there are the three groups mentioned above plus one service group which produces Hollerith cards and performs such functions as data reduction.

Operations Research at the Dept. of Defense level is performed by the Defense Office of Statistics, Operations Research and Automation. This is a very new group and no interservice studies are yet under way. The main task at present is collection of data from other services, selling OR concepts in general, organizing courses for all services, and assigning personnel (statisticians, OR practitioners, etc.) to the various service level offices. They are in the process of recruiting a top-level group of civilians for their own office. Some of the first areas the Defense level group anticipates is a study of anti-aircraft defense and the design of a war game with ground forces application.

Operations research as conducted within the Italian military is essentially statistical analysis. Some mathematical models are used, and when this is so the mathematics tends to be rigorous rather than sophisticated. OR, here, reflects a high mathematical competence but not necessarily an application of the scientific method. There is no use of Value Theory or economic methods. OR is not used for system prediction or selection. Selection remains a subject of priorities and budgetary persuasion. New systems are acquired on a pragmatic basis. OR's function in the decision

process is to take assigned problems from the General Staff or the Naval General Staff. Data are collected and analyzed and a report to the requisitioner is made. The staff decides if the study will be accepted or rejected. If accepted, results of the study may be subjected to operational test and further evaluation. Additional study based on these results may be desired and a final report submitted. The General Staff decides what promulgation or direction will then result.

Istituto Nazionale di Ricerca Matematica e Operativa per l'Urbanistica - The Istituto Nazionale di Ricerca Matematica e Operativa per l'Urbanistica (IRMOU), in Rome, is a non-profit organization founded in 1956. Its purpose is to study the problems of urban development. It claims to be the first such group in the world to apply OR to town planning.

IRMOU was founded on the professional ability and dynamic personalities of its President, Dr. Luigi Moretti (a prominent architect), and Vice-President, Prof. Bruno di Finetti (one of Italy's finest mathematicians). In addition, there is a highly competent staff of mathematicians, physicists, sociologists, architects, and representatives of other disciplines. Some are permanent staff, some are consultants.

The Institute performs its work for several agencies, among which are: the National Council for Research, the Ministry of Public Works, the City of Rome, the Ministry of Finance, the Ministry for Bureaucratic Reform (new), and the Auto Club of Rome. IRMOU does work for the last-named only in the Club's capacity as the executive appointed by the City of Rome to study the local traffic problem.

Some Studies Undertaken - A major study undertaken and completed by IRMOU was an analysis of the commuter traffic flow in and out of Rome. It involved the identification of patterns of traffic flow as a stochastic process. Twelve technically trained traffic counters determined the microphenomena in much detail. IRMOU suggested as a solution an automatic traffic routing system. The traffic is electronically analyzed and discretionary signals are displayed well in advance of decision points, offering motorists non-mandatory alternate routes. Coupled with this discretionary routing are traffic control light computers giving optimal signal times at the various intersections. The municipal authorities are just beginning to utilize the results of this study and have formed a Commission for the Scientific Study of Traffic.

Another study of twofold mathematical interest was the design of a stadium for optimum spectator visibility, utility and traffic flow, and the layout of the stadium's environs for optimum traffic flow. The two mathematical disciplines primarily exercised were topology and network theory.

Still another study developed a linear program to model the intradependence of small urban centers.

A unique continuing project of the Institute is the scientific development of urban law. Its objective is to measure the real world -- in this case, Roman traffic -- and evolve a set of legal norms which regulate the real traffic situation effectively. Methodology employed includes value theory.

The most interesting area described during this visit was a series of studies to determine the utility (value yield) of public works. This subject is very near the planning confrontations of the US Defense establishment. In brief, the present methodology is a culmination of di Finetti's lifework in subjective decision-making, and is the extension of his Bayesean viewpoint which was first expressed in 1935. This view underlies much of Dr. Leonard Savage's work in the same area.

Other studies analyze the migration of permanent residents into cities. Rome accommodates an additional 50,000 persons each year. What are the economic benefits of such influxes? The economic costs? Social costs (these new urbanites have much higher suicide rates than the older populations)? How then are all these measures equatable?

Last, the Institute is designing a system of statistics collection and retrieval which can best be described as a broad public utility providing information to public and private bodies and extracting data at the optimal transaction point.

Problems faced by IRMOU are the expected ones, involving acceptance of their output as valid. Even when the results are accepted, they are all too infrequently implemented. Since the Institute operates in an environment replete with perturbation, its staff

prefers to provide the best answer available now and utilize feedback to evolve self-generating future answers. The pressures are to provide one final answer which must stand the test of time.

Much of the Institute's time, therefore, is absorbed in the production of propaganda to get OR accepted and in the presentation of demonstrations of "what could be accomplished." This constant "sell OR" is made even worse by the relative instability of the Italian Government, at local and national levels. Established lines of communication are obliterated overnight and new, grandiose programs originate without inputs from the scientific experts.

The Institute must compete with non-scientific experts who offer empirical solutions in a "greenwave" where no one can be identified as responsible for an *ad hoc* solution.

IRMOU is not just another OR effort. The quality and size of its staff, coupled with past performence, presage major impact by this organization in the general field of OR as well as in city planning.

Operations Research at the Univ. of Rome - The Scuola di Perfecionamento in Ricerca Operativa, directed by Prof. Guiseppe Pompilj, is a prime indicator of Italy's increasing awareness of the value of OR as a discipline to be emphasized. The two-year postgraduate program offered at the Scuola is the only course in Italy which results in the title, "Specialist in Operations Research." The program is now two years old and none of the 20 students enrolled has yet passed the final examination. In addition, a thesis must be completed. The Department is determined to develop a quality product, and it would therefore appear that the two-year course will take a minimum of three years.

Courses and professors are listed below. Two unique factors stand out. First, all courses are thoroughly based in advanced mathemtics and should result in the graduates' having a depth which will add significance to results of their studies. Second is the inclusion of Bisi's course on Applications of OR to Defense Problems. Bisi's practical experience as Head of the Italian Navy OR Studies Branch, coupled with his PhD in mathematics, make him a teacher who is well qualified to cover this very important subject.

Program of Courses

First Year

Methods of Mathematical Optimization
Prof. A. Hertzel

Application of Mathematics to Economics
Dr. E. Zaghini

Theory of Games and Decision Making
Prof. G. Dall'Aglio

Statistical Processes and Queuing Theory
Prof. G. Ottaviani

Applications of Operations Research to Economic Problems
Prof. B. Barberi

Second Year

Applications of Operative Algebra and the Theory of Graphs
Prof. C. Berge ox
Dr. U. Colombo

Applications of Operations Research to Logistics Problems
Dr. F. Giusti

Methodology of Operations Research
Dr. G. Ferrara
Dr. S. Passeggieri

Applications of Operations Research to Military Problems
Dr. W. Bisi

Applications of Operations Research to Problems of Business Management
Dr. L. Lombardi

Staff publications cover a broad spectrum of subjects ranging from military applications to graph theory.

The Univ. of Rome program is indicative of the rapid increase in the utilization of highly sophisticated OR techniques by Italy.
(J.W. Hemann & P.D. Maycock)

PHYSICAL SCIENCES

Bio-Acoustics?

The program at a recent performance of the London Symphony Orchestra in the Royal Festival Hall contained a resume of current research in bio-acoustics. It indicated that during a recent test in the Hall, a note played mezzoforte on the horn measured approximately 65 dB of sound. As a reference point it noted that a single "uncovered" cough gave the same reading. Presumably in the interest of avoiding competition, the resume concluded with the request that when one needs to cough one takes the precaution to muffle the sound. It did not make recommendations for the horn.
(J.D. Costlow, Jr.)

British Acoustical Society

The newly formed British Acoustical

Society held its inaugural meeting, A Symposium on Aircraft Noise, 5-6 May 1966 at the Imperial College of Science and Technology, London. Six additional meetings were held during this year in London, Southampton, Birmingham and Manchester.

In December 1963, the Royal Society designated a committee to explore the possibility of setting up a single society which would cater adequately for all shades of opinion and interests within acoustics. Sir Gordon Sutherland, Chairman of the British National Committee for Physics, acted as chairman of this committee which reported favorably upon the proposal in March 1965. The committee, with the exception of the chairman, constituted a provisional council of the British Acoustical Society under the chairmanship of Dr. A.J. King. King is on the staff of Associated Electrical Industries Ltd., Research Laboratory, Manchester, and the Physics Department of Manchester College of Science and Technology. His duties as council chairman ended with the election of officers and a council in November 1966. The new officers, elected for two-year terms, are Prof. R.E.D. Bishop (Univ. Coll. London) as President; Prof. E.J.Richards (The University, Southampton) as Vice-President; Prof. E.C. Cherry (Imperial Coll. of Science and Technology, London) as Vice-Pres.; Mr. W.A. Allen (Associated Architects and Consultants, London) as Vice-Pres.; Dr. A.J.King (Past President) as Vice-President; Dr. P.Lord (Royal College of Advanced Technology, Salford) as Hon. Secretary; Dr. R.W.B. Stephens (Imperial College of Science & Technology, London) as Membership Secretary; and Mr. I.J. Sharland (The University, Southampton) as Hon. Treasurer. Members of the Council elected for three years, one-third retiring each year, are Dr. D.E. Broadbent (Pembroke Coll., Cambridge and Fellow of the Acoustical Society of America), Mr. P.E. Doak (The University, Southampton and editor of Journal of Sound & Vibration), Dr. C.L.S. Gilford (BBC Research Department, Tadworth, Surrey), Mr. F.B. Greatrex (Chf. Engineer at Rolls-Royce, Ltd.), Dr. W.Taylor (Queen's College, Dundee, Scotland) and Prof.D.G.Tucker (Univ. of Birmingham). Tucker is also the Society's Program Chairman. The junior member of the council is Mr. P.G. Vaidya (The University, Southampton).

At the meeting in Manchester, 15 November, King announced the results of the election and that the Society now has 292 members, 21 of whom are from abroad. In ESN 19-4, it was stated that the committee was considering whether to make the Journal of Sound and Vibration the official publication. This did not happen; however, nine of the newly elected officers and council members are on the editorial board of the Journal. Moreover, the announcement of the newly formed Society in the Journal, March 1966, offered "the full services of the Journal of Sound and Vibration as a medium for publication of papers, and of announcements and news of Society affairs."

The constitution and rules, as approved Oct. 1966, state "The purpose of the Society is to promote and disseminate knowledge of acoustics, which shall be deemed to include all aspects of the science and technology of Sound, Hearing and Vibration." There are five memberships; member, associate, junior member, honorary member and sponsor member. Members and associates pay £3, junior member £2 per year.

A meeting of the Society was held at Imperial College, London, 20 October on "Investigation of Defects in Solids Using Acoustical Techniques." Dr. G. Bradfield (recently retired from the Physics Division, National Physical Laboratory) properly opened the meeting with a tutorial paper entitled, "Reradiation from Singularities in Solids." A similar paper was read by Bradfield at the ICA meeting in Stuttgart in Sept. 1959. Mr.G.J.Curtis (Imperial Coll.) discussed "Ultrasonic Energy Transfer Across Thin Gas Layers." He used a disc of PZT-5 backed with a mixture of tungsten powder and araldite to measure the transfer across an air layer between glass flats. Negligible transfer occurs for a layer thickness of 2.1×10^{-6} cm according to the Hirschfelder model, 3×10^{-6} cm according to the Levi Tonks model, and 2.2×10^{-6} cm for the Feze Gurzey model. His data agreed with the last model. Dr. D.I. Crecraft (Lanchester College of Technology, Coventry) presented several curves without numerical coordinates on "Detection of Residual Stresses in Metals by Ultrasonics." He plotted the propagation velocity for shear waves parallel and perpendicular to the stress and longitudinal waves. He said, during the questions, that the variation is 1 part in 10,000

in steel for 1 ton/in^2. Mr. A.A. Pollock (Imperial Coll.) discussed "Acoustic Emission During Deformation." He used a thermal load mechanism to reduce ambient noise and detected no sound emission before brittle fracture.

The meeting on 15 November at The Royal College of Advanced Technology, Salford (Manchester) was called "Reverberation Time and Transmission Loss Measurement." Papers were presented by Mr. E.N. Bazley (National Physical Laboratory), Mr. B.F.Day (Royal Coll. of Advanced Technology, Salford), Dr. K.A. Mullholland (Liverpool Univ.) and Mr. A.N. Burd (BBC Research Lab., Tadworth). Bazley described the "General Problem of Reverberation Measurement," showed the characteristics of the reverberation room at the National Physical Laboratory, and presented curves of the reverberation time T vs humidity and frequency, the edge factor vs panel size for absorption measurement and the effect of diffusers in panel absorption measurements. Sound level measurements are made at five room positions at high frequencies and at 20 for low frequencies. Day discussed his measurements of reverberation in scaled models. Polystyrene foam is used to represent the seats, and squares of cardboard represent people's heads. The gain of the amplifier increases with time to compensate for the greater sound absorption in the air at the scaled frequency. The average of 30 or 40 growth curves for pulses of different length is used rather than the decay curve. Data is obtained from the slope at the midpoint of the first 10 dB of the growth curve. Comparison of the two models of the Oslo Concerthaus, one with a flat roof and the other with a coffered roof, showed a 40 to 50% higher reverberation time for the coffered roof.

Mullholland's paper, "Transmission Loss of Materials with Low Sound Insulation," compared theory and experiment for the transmission loss of a wall, consisting of two aluminum sheets separated by air, for normal and random incidence of sound. An absorbing coat on the inner wall, 12-inch separation, showed little change in transmission loss at 500 Hz, but showed a marked increase at 4 kHz.

Burd's paper was entitled "Measurement of Sound Insulation in the Presence of Flanking Paths." He analysed several methods for separating the various transmissions by determining the delay time. The correlation technique gives good data in a low signal-to-noise but requires laboratory processing after the data is obtained. Pulsed sound measurement is limited by the signal-to-noise ratio but can be processed during the test. Accelerometer measurements on a panel are time consuming if sufficient position points are taken. A revolver-shot method requires frequency analysis in the laboratory after the tests have been made. A gradient microphone can be used as a substitute for accelerometer measurements. In the correlation technique Burd used signal plus fixed delay representing the direct transmission path and signal plus variable delay. Random white noise with a sweeping octave filter gave the sharpest correlation function.

A joint conference sponsored by The Institution of Electrical Engineers, Institution of Electronic and Radio Engineers, the United Kingdom and Eire Section of the Institute of Electrical and Electronics Engineers, the Institute of Physics & the Physical Society, and the British Acoustical Society will be held at The Institution of Electrical Engineers, Savoy Place, London, 23-27 January. The subject is Acoustic Noise and its Control. Sessions have been arranged on Subjective Effects, Measurement Analysis, Machines and Noise in Buildings. Three tours are planned for 27 January: (1) Building Research Station, Gurston, Watford and Standard Telecommunications Laboratories, Harlow, (2) National Physical Laboratory, Teddington and London Airport, (3) Institute of Sound and Vibration Research, University of Southampton.

The first annual dinner of the British Acoustical Society will be held at Imperial College of Science and Technology on 24 February. Other meetings planned are: March, at the Institute of Sound and Vibration, Southampton on Helicopter Noise; April, at Glasgow on Medical Acoustics; May, at Rotterdam Concertgebouw on Criteria for Good Acoustics (held jointly with the Acoustical Society of the Netherlands); June, at Lanchester College of Science and Technology, Coventry, on Plant Noise; and July, at the Institute of Sound and Vibration, Southampton, title, Congress on Audiology.

Members receive information on short courses and symposia in the area of acoustics not sponsored by the Society. Announcement has been

received of the Second British Academic Conference in Otolaryngology to be held in Oxford 30 July - 4 August covering Sensori-Neural Deafness of Peripheral Origin, Conservative Surgery of the Larynx, Chemotherapy in Head and Neck Cancer, Facial Paralysis and The Catarrhal Child. Correspondence should be addressed to L.F.W. Salmon, Keat's House, Guy's Hospital, London, S.E. 1 (W.J. Trott)

The New Campus for Physics at the ETH, Zurich

The postwar emergence of science and academic education as a matter of national concern has involved the countries of Western Europe irrespective of their size. Industrial development definitely was not curtailed during WWII in Switzerland. However, the country has realized in the last few years that its facilities of higher education must drastically be expanded in order to maintain her position in the technological race. In a previous issue of ESN (19-10, p.168) B. Epstein reported on a message from the Swiss national executive council (Bundesrat) to the national assembly (Bundesversammlung) which proposed a plan for improving and extending the facilities of the ETH (the Swiss Technical University). The message included a request for appropriation of 444 million Swiss francs (about $103 million) to meet the costs. Since then, the proposition has been approved and the expansion is well under way.

This note reports on the share of physics in this expansion project. It is a large share, indeed, and emphasizes the importance of physics as the basic science in an institution of mainly technological orientation. Two hundred eighteen million francs, or nearly 50% of the total allocation, is earmarked for a move of the physics faculty to an entirely new campus outside Zurich, on the Höenggerberg. The work is to be completed within the next three to four years, placing a considerable strain on the limited financial resources of this small country. If the total project would be measured in fractions of the gross national product, it would represent an investment of the order of $10 billion in the US, to be spent over a relatively short time. The allocation of nearly half of the expansion project to physics takes into account the almost explosive growth of this discipline inside the total spectrum of science as represented in the University. If the year 1922 is taken as the reference point, the last year in which buildings were added to the University complex on a large scale, the total number of students has grown from 1845 to 5436 in 1965, enlarging the student body by a factor of three. In the same interval the number of students in the Department of Mathematics and Physics has grown nearly ten times as rapidly (from 24 in 1922 to 624 in 1965). That this is not just a general university trend, but reflects a very peculiar interest in physics, is shown by comparison with the chemistry Department. The number of students in this closely related sister science has only grown from 290 to 481, not even reaching the gradient of the total growth.

Most European universities established a century ago, were integrated into the cities at a very early date, long before the limitations on expansion and the interference of modern traffic were any argument against a downtown location. Accordingly, such universities are faced with the problem of what to do about moving the fastest growing and most sensitive part of their facilities out of town. With the exception of the Sorbonne, which has a giant construction project under way right in the downtown area of Paris, these universities have started to build new campuses at the periphery of the cities. The old buildings in town are left to the administrators and/or the faculties which are less affected by the mechanical and electrical interference of modern city traffic.

It is possibly worthwhile to mention the manner in which these remaining facilities in downtown Zurich are being expanded in a cheap and clever way. Like many of the public buildings in Europe conceived around the turn of the century, the main building of the ETH consists of a number of huge squares of wings which enclose a small court necessary to let light into the rooms on the inside of the square. Modern ventilation techniques have eliminated the need for windows, consequently the area of these square courts is available for expansion. At the same time, the outside of the building is left untouched, which is important in this case since the main building of the ETH is considered an art treasure.

It was designed by Semper and is listed in the guidebooks on Zurich. The huge green-domed building, halfway up the hills, is a beautiful landmark that can be seen from most parts of the city. The planned expansion will not spoil this sight. The basements of the courts are to be filled with power plants and ventilation machinery with lecture theaters in the middle stories. This is topped off by additional rooms on the upper floors for the Central Swiss Technological and Patent Library.

Two further aspects of this downtown project are possibly typical of the change in European academic life. The present student restaurant is entirely inadequate for the increased number of students and the increase in the portion of their working time which is now centered in the laboratories. A generous expansion shall take this into account. Secondly, the present "Auditorium Maximum" is to be converted so as to service more useful function. These huge halls which exist in most European universities as a center of the cermonial climaxes of academic life, usually remind one more of royalty and the opening of parliament than of the communication and discussion of science. The things the Swiss plan to install in their Auditorium Maximum clearly indicate its present defects. The hall will have a blackboard, projection facilities, new chairs with small tables, microphone and loudspeaker system, as well as an adequate illumination and ventilation system. Thus, it will become a multi-purpose lecture theater and not just a room for ceremonial representations.

The major part of the University expansion project involves the relocation of the Physics Department from its present scattered downtown locations to a brand-new campus, which is in the process of being built on a hilltop approximately two miles west of the city. The new buildings will eventually accommodate the different institutes that form the Physics Department: Laboratory for Nuclear Physics, Laboratory for Solid-State Physics, Seminar for Theoretical Physics, Institute for Technical Physics, Institute for Molecular Biology and Biophysics, and the Institute for Geophysics and Physics of the Atmosphere. Within the Physics Department, the directors of the six institutes form a democratic body and each serves a two-year term as the head of the Department. This position is responsible for all the facilities that the six institutes have in common, such as administration, the machine shop and the largest part of the teaching facilities. Inside the individual institute, of course, a more autocratic structure prevails, and the whole system is not quite an equivalent to the American Departmental structure.

The new campus can roughly be divided into three separate complexes. In the first are buildings for the six institutes. Only the building for nuclear physics containing the largest machine - a Van de Graaff accelerator - has been completed. The building for technical physics will have a separate tract for the so-called Department of Industrial Research (AFIF), an organization resembling the Battelle Institutes but opening their facilities for contract research to the graduate students of the University. The building for theoretical physics (a group which had such names as Clausius, Einstein, Weyl, Schroedinger and Pauli on their payroll at one time or another) also houses the central physics library for the campus.

A second complex on the campus represents the facilities which are used jointly by all six Institutes, mainly the power plant, the helium liquefier and the central machine shop.

The third complex has evolved from the belief that teaching and research should be separated. The part close to the entrance of the campus is exclusively devoted to teaching facilities, which are used by all six groups in common. An 11-story building houses different kinds of work rooms and small lecture rooms in addition to the rooms for laboratory courses, the "Praktika." A large, octahedral, low building accommodates the big lecture theaters.

The campus is too far out to permit the students to lunch in town. A large restaurant near the entrance will take care of this and also cater to the permanent staff. It is somewhat unusual for a European university to plan residential facilities for the students, but it has been done for this project. The residential area will eventually provide 800 - 1000 beds and is even being given priority over other parts of the

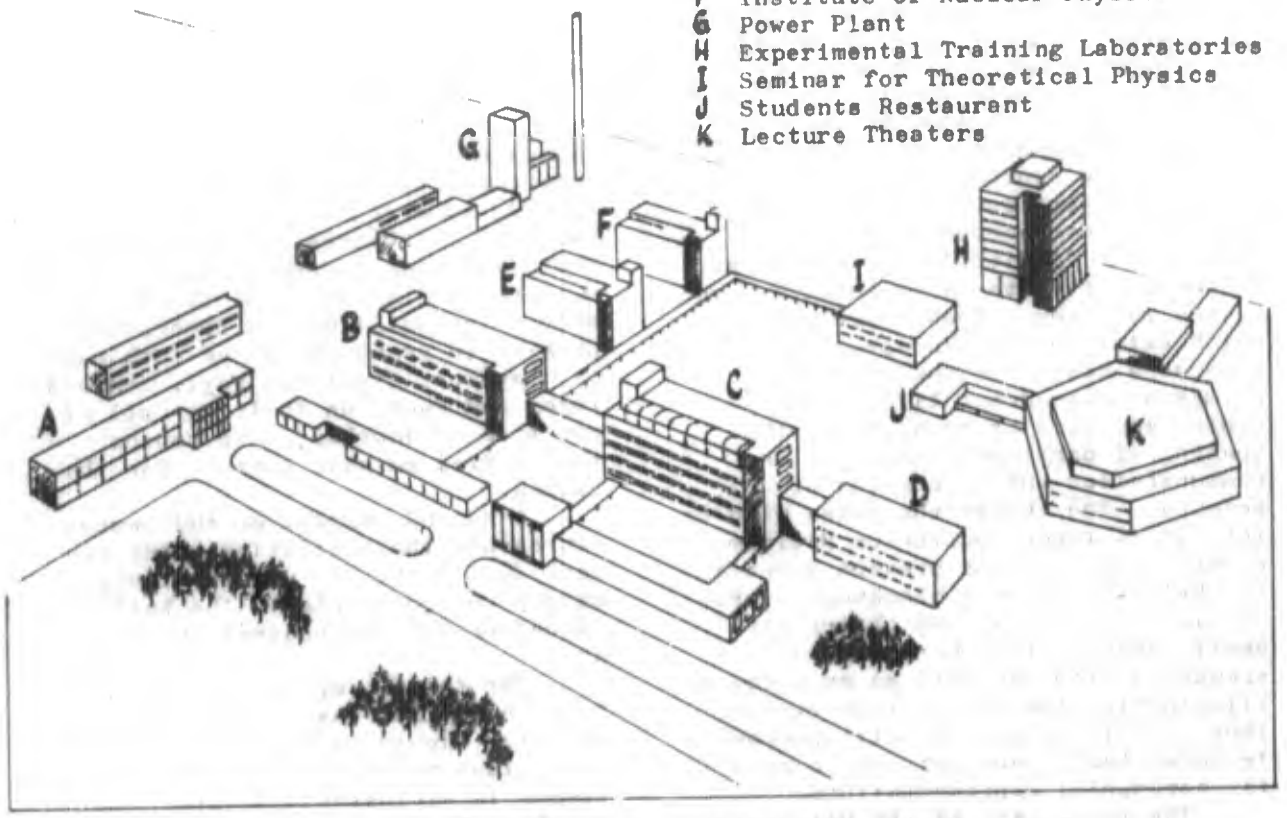
program.

When completed in approximately two to four years, the new campus will give research and teaching in physics at the Swiss Technical University an adequate and sufficient home for some time to come. If Swiss industry decides to give the graduates from this renowned and excellent facility of higher education the proper and challenging opportunity to work, Swiss research in physics cannot fail.

(B.O. Seraphin)

Legend:

A Central Machine Shop
B Solid State Physics
C Department of Industrial Research
D Institute of Technical Physics
E Institute of Molecular Biology
F Institute of Nuclear Physics
G Power Plant
H Experimental Training Laboratories
I Seminar for Theoretical Physics
J Students Restaurant
K Lecture Theaters



THE NEW CAMPUS FOR PHYSICS AT THE ETH ZURICH

Radar Measurements on Sea Targets at Flensburg, Germany

Eltro GmbH Company is a private corporation employing 600-700 people with headquarters in Heidelberg. The company specializes in the fabrication of absorbing materials for radio frequencies, microwaves and infrared, and in measurements equipment of these wavelengths.

Dr. Gerhard Beck is in charge of an Eltro field site which employs 90 people and is located in Flensburg on an estuary of the Baltic Sea. He has recently completed an extensive measurements program on the range dependence of echo power from sea targets at the Flensburg site, where one can see the Danish coast just two miles away. The measurements were made simultaneously at S, C and X-bands for ranges of a few hundred meters to 10,000 meters. Targets investigated included simple reflectors, small boats and ships. Because of differences in the range dependence of signal strength for various sizes and shapes of targets and for the

various wavelengths, no attempt has been made by Beck to report the data in the form of radar cross section. In other words, the primary objectives of the program were to determine the effects of the sea and the atmosphere on echo strength.

Field Sites and Instrumentation - Most of the measurements made by Beck have been over water for ranges between 400 and 10,000 m, but limited measurements have been made over land and ice. The measurements over ice and water were made at S, C and X-bands on the Inner Fjord at Flensburg, but the land measurements were made at S-band only on an airfield runway. All azimuthal beamwidths used were between 1^{o} and 2^{o}, pulse lengths were approximately 0.1 μsec, and the wavelengths were 3.2 cm, 5.5 cm and 9.35 cm. Polarization was horizontal. Transmitters were synchronized so that measurements could be made simultaneously, and the pulse repetition frequency was approximately 1000. The equipment was built specifically for measurements and analysis; for example, antennas are synchronized and targets were tracked via television. Antenna gains were between 25 and 30 dB, and dynamic range of each system was approximately 65 dB. Elevation beamwidths were broad, therefore tracking in elevation was not required.

Background - If spherical waves are reflected from a sufficiently large plane surface, the backscattered wave appears to come from a virtual image of the transmitter antenna. In this case, received signal power varies with range R as $(2R)^{-2}$. Therefore, backscattered power from a large flat reflecting surface, say from the side of a ship, might be expected to vary as $(2R)^{-2}$ at short range. The transition range between which one would observe the usual R^{-4} dependence and the $(2R)^{-2}$ dependence would be strongly influenced by surface shape. For a disc of diameter D and an antenna of diameter d, one would expect the transition range to be in the neighborhood of $2(D+d)^2/\lambda$. The reader will recognize this expression as that from antenna theory which is used to determine the transition between the Fresnel and Fraunhofer zones.

For studies of targets over a reflecting surface, combinations of the two distinct paths must be considered: (1) the most direct path between antenna and target, and (2) the most direct path between antenna and target and for which the wave is reflected off the water. Paths (1) and (2) will be referred to below as simply "direct" or "reflected," respectively.

At ranges for which backscattered power would vary as R^{-4} in free space, the effect of interference (cause by the difference ΔR in path lengths between the direct and reflected waves) is sometimes observed. For a corner reflector at constant height above water (or other target for which prominent scattering elements are confined to a small volume), nodes and antinodes are observed in received power as a function of range. For horizontal polarization, the reflection coefficient for a smooth water surface has a magnitude of essentially one and a phase shift of 180^{o} for all angles of incidence. Therefore, the envelope of the antinodes would, in principle, vary as R^{-4}.

At still greater ranges such that ΔR is less than $\lambda/2$, but for ranges shorter than that to the optical horizon, target power is expected (in principle) to vary as R^{-8} because of the interference effect. Examples of experimental data that depict transitions between the R^{-4} and R^{-8} zones may be seen elsewhere (L.N.Ridenour, Ed., Radar System Engineering, McGraw-Hill, New York, 1947, p. 51).

The above discussion neglects effects of the earth's atmosphere and its curvature. Electromagnetic waves propagating within the earth's atmosphere do not travel in straight lines but are generally refracted. One effect of refraction is to extend the distance to the horizon, thus increasing radar coverage; another effect is the introduction of errors in the measurement of elevation angle. The classical method of accounting for atmospheric refraction in computations is to replace the actual earth of radius a by an equivalent earth of radius ka and by replacing the actual atmosphere by a homogeneous atmosphere in which the waves propagate in straight lines. It is customary to use a value of $k = 4/3$ as simply a convenient means for approximating effects of refraction.

Measurement Results - The results presented below are based on data measured simultaneously at S, C and X-bands:

Simple Reflectors - The effects of interference were studied by

observing the received power, as a function of range, from radar reflectors that were maintained, by means of a raft, at several meters height above the water.

a. For ranges of 3000 m and less and for antenna and target heights small compared to range, received power varies as R^{-8} in the region where the path difference ΔR applicable to a curved earth surface is less than $\lambda/2$.

b. For ranges greater than 3000m, it was necessary to include effects of refraction due to the troposphere in order to account for echo power versus range. The value of k of 4/3 showed up as a useful average for effective range calculations, but effects of the atmosphere caused received power to vary between R^{-4} and R^{-12} for ΔR less than $\lambda/2$.

c. If $\Delta R > \lambda/6$ (calculated for normalized earth radius of 4/3), the received power varied as R^{-N}, where $N < 8$; if on the other hand $\Delta R < \lambda/6$, it was found that $N > 8$ with maximum N approximately 12. Changes in N are attributed to changes in beam curvature caused by variation in meteorological conditions.

d. For path length differences greater than $\lambda/2$, nodes and antinodes were observed as a function of range. The measured positions of the nodes and antinodes depend on transmitter wavelength, and occur at the positions predicted by ray theory and a smooth dielectric surface (for the sea). The envelope of the peaks in the interference pattern vary as R^{-4}, in accordance with theory.

e. The dielectric properties of the ground, the ice, and the water surfaces had no recognizable effect on received power, presumably because the heights of the antennas and the targets were small in comparison with the test range. Even the choppy water in the Flensburg Inner Fjord had practically no effect on the curve of received power versus range for low antenna heights and ranges of less than 10,000 m.

Ships - For ships (geometrically complicated reflector shapes), the dependence of received power on range was found to be strongly influenced by ship aspect angle. The following observations were made for ranges of 500-10,000 m on a 3000-ton vessel illuminated from astern.

	Range Dependence		
	R^{-2}	R^{-4}	R^{-8}
S-Band	R<1500m	1500m<R<5000m	R>5000m
C-Band	R<1500m	1500m<R<7000m	R>7000m
X-Band	R<1500m	1500m<R<10,000m	--

An R^{-2} dependence has been observed in the received power from several small boats and ships. When it exists, it seems to be associated with aspect angles for which back scattering from flat surfaces would tend to be prominent. The wavelength dependence for the transition between the R^{-4} and R^{-8} regions above is, in general, consistent with theory; that is, for a decrease in wavelength, other conditions being equal, the ranges between the regions of differing range ratios are expected to become longer.

Future Programs - The previously decribed measurements program was supported under contract with the West German Navy, and Beck is currently seeking support for further radar measurement studies. He is, however, performing studies in connection with obtaining refinements in radar absorbing material to further improve the Eltro product line.

Several radar measurement systems are presently under development for the German Ministry of Defence, and Beck hopes to expand the market for these systems. There are three quite flexible types of systems under development: one that is truck mounted for ground measurements, another for ship use and the third for aircraft installation. Each system provides for simultaneous measurements at S, C and X-bands with horizontal polarization. The radars include A-scope and PPI presentations and facilities for read-out of pulse counts versus range. Statistical processing equipment is available so that average values can be automatically printed out as a function of range. Antenna speeds, as I recall, are variable and operate between approximately 2 and 20 rpm. Instrumentation is included for recording humidity, temperature, wind speed and wind direction automatically on the radar data sheets. (M.W.Long)

PSYCHOLOGICAL SCIENCES

Chairman's Address, Occupational Psychology Section, British Psychological Society

The annual General Meeting of the Occupational Psychology Section of the

BPS is marked primarily by announcement of newly elected officers and a major address by the outgoing chairman (president). This year's meeting was held at Birkbeck College, London University, on December 2nd. Dr. Alec Martin, a psychologist at the Ministry of Labour, was installed as Chairman for the coming year; and, Professor Albert B. Cherns gave the Chairman's address, entitled "Putting Psychology to Work."

Cherns, who is one of England's more influential psychologists, until recently has been head of the British Social Science Research Council. He now has assumed a newly established Chair in Social Science at the University of Technology, Loughborough, Leicestershire. The timing and content of Cherns' paper was particularly appropriate, as he discussed a problem area in psychology which will form the basis for his new research unit at Loughborough. In essence, Cherns is concerned with the failure of social scientists to apply or utilize fully their fund of technical knowledge in the real world. His concern is not with fostering applied research, per se. Rather, the basic issue is that there are few social scientists engaged in what corresponds to the "engineering or development" function of the physical sciences, and that there is no provision for training individuals in this area. Two separate dimensions of this problem were discussed at some length.

First, it is Cherns' contention that applied work in psychology often fails to make the contribution which it might because of a failure to give sufficient consideration to the total system in which the results are to be utilized. He illustrated this point with an example drawn from his own research experience. Here, a study of training attrition in the RAF was carried out which resulted in recommendations for change in the organizational structure of a large training command. The study was technically sound, and the recommendations highly appropriate at the level of the training station. However, the recommendations could not be implemented as they would have created an even greater problem for the RAF as an organization by throwing the career ladder for instructors out of line. Thus, the failure of this research effort was due to a lack of attention before the study was started to the boundaries or basic perimeters of the system concerned. While this point should be self-evident, Cherns presented ample corroboration of its neglect to date in industrial psychology.

Beyond the problem of selecting the proper frame of reference or system in which to undertake social science research, Cherns advocates further systemic work on the mechanisms of applying research results. He sets forth three ways in which results of psychological research are applied or used: (1) by change in the climate of opinion, (2) by diffusion, and (3) by deliberate planned application.

As a classic example to illustrate the impact of "change in the climate of opinion" on the application of psychological research findings over the years, Cherns reviewed developments in the area of industrial productivity since 1915. A report of the Health of Munitions Workers Committee was issued at that time which disclosed that there was not a linear relationship between hours of work and output. Cherns considers this report (startling at the time) had sufficient influence on attitudes and opinion to pave the way for much of the industrial psychological research which underlies what is now traditional management practice. The most common means at present of implementing social science research findings by means of "climate change" is through courses for managers in business and industry. However, without question, this is a time-consuming and drawn-out process.

"Diffusion" is seen as a more rapid but also more dangerous mechanism for implementing applied social science research. Diffusion occurs through mobility of managers, supervisors, etc., in industry. Procedures and programs which have worked in one setting are applied in a new organization. Unfortunately, a program developed within the total system complex of one organization may be quite inappropriate when lifted out of context and established in another. It is here that Cherns sees the most common misapplication of social science research.

To date, "deliberate action" in application of research results is considered, for the most part, to have taken place only under an unusual set of circumstances. Cherns traced the development of five fields of

psychological research - ranging from large-scale aptitude and ability testing through human factors - which are highly active today in industrial settings. In each case, the development and application of fundamental psychological knowledge in the specific research area was precipitated by a significant wartime need. Thus, it would appear that the optimal conditions for deliberate application of research in the past have been: (a) a crisis of national proportions, such as war, (b) an adequate supply of trained persons to undertake the required research, and (c) an identity of the sponsor and user so that the investigator assumes an integral role in the organization or system. However, the transition of the wartime advances to industry typically has occurred through the processes of "change in climate" and "diffusion." Cherns quite obviously is of the opinion that this need not and should not be so.

In a parenthetical diversion during the paper, Cherns gave some of his notions on the basic research - development dichotomy. Not only does he consider the familiar research - development - production model to be an improper conceptualization of the process through which psychological research is applied, he points out that studies have shown that this model does not truly describe the process in any area of industry or technology. In the same vein, he rejects the argument that social science research cannot be applied because the significant fundamental studies have yet to be carried out. It would appear that Cherns advocates a blending of basic and applied research with a continual feedback which is not handicapped by artificial dichotomies.

Cherns' address was well prepared and extremely well delivered. The message he wished to convey came through not so much because of startling new ideas, but through his organization and logic. The very putting together of facts "everyone knows" outlines an important and neglected problem which must receive far more formal attention than it has in the past if psychology is to make the contribution which many believe is possible. Cherns and his new unit are devoted to a calculated effort in this direction.
(J.E. Rasmussen)

MISCELLANEOUS

The Engineer's Day

The problem of attracting capable young men and women into the engineering profession seems to be as critical in the UK as in the US, judging from the size and quality of "The Engineer's Day" program at the Science Museum, London. This two-months-long "careers exhibition" is being presented by a group of nationalized bodies and British Government departments with the cooperation and support of the Council of Engineering Institutions and the Confederation of British Industry.

On the Museum's ground floor, over 7000 ft^2 have been given over to the exhibition. A series of displays presents the lives led by engineers of all kinds against the background of their work. Civil, mechanical, electrical, transport engineers, etc., are depicted as constantly dealing with people and their needs. Some examples of the displays are given below.

A transparent model of the reconstruction now under way of the Oxford Circus Station to accommodate the new Victoria (subway) Line is exhibited next to a series of photographs which show the progress in various aspects of tunnel construction. An experimental line of twin tunnels, one mile long, is shown wherein two types of tunnel construction were tested. In one, the tunnel wall is lined with a form of flexible-jointed cast-iron lining which requires no bolting or grouting. The other type is lined with concrete segments. Both wall liners are expanded under pressure against the clay.

The engineer in medical research is illustrated by a series of slides on "Myoelectric Control of an Artificial Hand." An accompanying commentary describes work done by the Medical Research Council at West Hendon Hospital and at St. Thomas' Hospital which led to the development, at the Atomic Weapons Research Establishment, Aldermaston, of a miniaturized control circuit and artificial hand. The hand is controlled by myoelectric currents -- the currents which normally stimulate muscle. Operating signals are taken from muscles remaining in the forearms of amputees by surface electrodes in the socket encasing the stump. The system consists of the artificial hand, an electronic control

unit, and a rechargeable battery.

The National Coal Board has constructed a surface control room for the automated coal mine of tomorrow. An operator sits at a console at the exhibit, surrounded by TV screens, control buttons and telephones. As the activities in the mine proceed on the TV screens, the operator performs a sequence of control functions for the benefit of the audience.

In general, the exhibit consists of hardware, films and slides with commentary, and working models. Each exhibit is staffed by one or more engineers who answer questions and hand out well-prepared brochures on opportunities with his service or department. In all, there are about 17 exhibits.

After viewing the regular exhibits, the visitor reaches the "Hall of Industry," where there is time for thought and questions before leaving. Amid displays showing particular products selected for their interesting technical features and good design (e.g., a precast unit of structural concrete, a ship's propellor, an auto chassis, a segment of the cast-iron type of tube lining for the Victoria Line), representatives of such bodies as the Central Youth Employment Executive of the Ministry of Labour and the Council of Engineering Institutions are available to discuss career opportunities. Advice and information on the various routes by which one can become a professional engineer are also available.

The exhibition was augmented by a series of lectures and films in a nearby auditorium. A typical lecture title was "Building the Channel Tunnel." Included in the films presented every 30 minutes were: "Men of Power" (work and training of engineers in the electrical supply industry); "Forest Products Research" (Government research in timber technology); "Test Flight 263" (research behind high-speed test flights); "Creativity at School" (technology projects at Sevenoaks School); and "New Minds for a New World" (national attitudes to science and technology).

Finally, it should be noted that an excellent brochure had been prepared for each visitor, which describes the reasons for the exhibition, presents some photographs of engineers at work, mentions their accomplishments, and quotes opinions on the profession by many noted professional engineers. (H.E. Williams)

Politics in Education

Two situations have occurred in recent months on this side of the Atlantic which illustrate extremes in the spectrum of politics in education. On the one hand, students in Sweden were without teachers when the Government locked out the faculties (they are civil servants) in retaliation against a teachers' strike primarily in the gymnasiums (advanced high schools). At Stockholm's Royal Institute of Technology, this meant that the faculty could not get into their offices and students could attend laboratories only when student assistants were in charge. At the grade school level, students were required to spend regular hours in the classrooms, but could do as they pleased. Listening and dancing to music from transistor radios were very popular. In the end, the gymnasium teachers got a little more pay and the doors were unlocked. Several weeks later, the Swedish Government still had not decided whether the teachers were expected to make up for lost time or simply cover a little less material this year.

On the other hand, in Israel, undergraduate students at the Technion went on strike over a proposed increase in fees of about ten percent. While student leaders met to discuss the issues, the rest went on vacation. When the faculty threatened to force all to repeat the semester unless they returned in time to fulfill a minimum requirement of lectures and laboratory sessions, the students decided to return, but not until they had taken their annual, two-day Hanukkah holiday! (H.E. Williams)

NEWS AND NOTES

At the annual Anniversary meeting of the Royal Society, the President, Prof. P.M.S. Blackett, predicted that British science should benefit from the growing number of contacts between the Society and the Government. He said he would welcome the extension of these working contacts; however, it was equally important that the Society should possess a strong independent base from which to operate, with adequate financial support from private sources. Following the move last year to open the ranks of the Society to applied scientists, Blackett

announced the award of three medals for work associated with engineering design. These go to Sir William Penney (Chairman, UK Atomic Energy Authority), Mr. Christopher Cockerell (inventor of the Hovercraft), and Mr. Alec Issigonis (Technical Director, British Motor Corporation, and designer of the "Mini" and "1100" automobiles). A new gold medal and prize of £1000, to be awarded annually for an "outstanding contribution to the advancement of science, engineering or technology leading directly to increased national prosperity," was also announced. A sum of £20,000 has been donated by the Mullard Company for this purpose.

The French and German Governments have come to an agreement to build a high flux nuclear research reactor at Grenoble. The cost, estimated at 160 million francs ($32 million) will be jointly shared by the two countries, and it is contemplated that the reactor will begin operation in 1970.

Sweden and Britain have just completed joint experiments in the evaluation of "head-up" displays in aircraft, at the Minerva Laboratories, Treforest. The British equipment has been developed by Specto Aviation, Feltham, and Elliott Flight Automation, Rochester. The Swedish companies participating were Svenska Radio and the SAAB company.

The French Coralie rocket has had a second experimental firing in the Sahara and reached a height of 35 miles. The rocket will be the second stage of the combined Europa I space rocket.

The Royal Military College of Science, at Shrivenham, Wiltshire, is seeking the right to confer its own degrees, which now are granted by London University. If this autonomy is achieved, the College plans to slant its syllabus towards subjects of practical army application. A pass degree has been substituted for the Higher National Diploma as the minimum qualification for associated membership of the Institution of Mechanical Engineers, and the Institution of Electrical Engineers, for which officers of the Royal Electrical and Mechanical Engineers (REMEs) must qualify.

A grant of £32,000 (£1=$2.80) has been made to the Hatfield College of Technology for the establishment of a National Reprographic Center for Documentation. The Center will be concerned mainly with photographic methods of reducing original documents to microforms for storage, handling, retrieval and enlargement.

Hawker Siddeley Dynamics is manufacturing receiving stations for taking pictures fromweather satellites. The British Meteorological Office have bought five of these stations; and, Cyprus, Singapore, and the Maldive Islands also have installed them. The receiving apparatus is housed in a 10 ft^2 wooden hut, weather-proofed for any climate, and only one operator is needed to point the corkscrew aerial on the bearing over which the satellite will pass. The satellite's signal switches on a photoduplicating machine which will show cloud formations over a 400,000 mile^2 area of the earth's surface.

An inter-university link is being established between the Universities of Lancaster and Sussex with the proposal to establish a joint center of Operational Research. The plan is that OR departments at both universities should share staff, and work jointly in the North and the South on research projects. Some of the plans presently under discussion are that specialist staff should lecture at both universities, that students who earn their Master's degree at one University should earn their PhD at the other, and that research projects where national problems are involved might be shared.

A Chair of Telecommunications Systems is to be established in the Dept. of Engineering Science, Univ. of Essex, after an agreement between the University and the General Post Office.

A full-scale model of the Concord supersonic airliner is under construction for exhibition at the Paris Air Show next May. Costs are being borne by the four main companies engaged on the aircraft - British Aircraft Corporation, Bristol Siddeley Engines, Sud Aviation and Snecma - together with other sub-contractors. The Ministry of Aviation, on behalf of the Royal Navy, has placed an order of £24 million with Westland Aircraft for the development and supply of

Westland twin-engined helicopters, scheduled for service early in 1969. The new helicopter is a version of the Sikorsky Sh-3D or "Sea King," powered by two Bristol Siddeley Gnome 1400 gas turbines. It has a heavy load carrying capacity, which will make it suitable for carrying 20 fully equipped troops as well as for an anti-submarine weapon system and other naval tactical tasks.

Sir William Penney, Chairman of the United Kingdom Atomic Energy Authority, will leave his present post in October to become Rector of the Imperial College of Science and Technology, London, a position which has been vacant since the death of Sir Patrick Linstead three months ago.

Prof. Sir Willis Jackson, FRS, Head of the Department of Electrical Engineering, Imperial College of Science and Technology, London Univ., heads the New Year's Honours List. He will be a baron in recognition of his services to technology. Other names of interest in the scientific field honored in the List are Frederick Bawden, Director of the Rothampsted Experimental Station (Knight); Michael Perrin, Chairman of the Wellcome Foundation (Knight); and Prof. Ronald Tunbridge, Professor of Medicine, Univ. of Leeds (Knight).

Dr. M.R. Sampford, presently senior principal scientific officer in the Agricultural Research Council Unit of Statistics at Edinburgh Univ., has been appointed to a new Chair of Mathematical Statistics.

A. Kesselring, the Swiss managing director of the European Centre for Space Technology, at Delft and Noordwijk, has submitted his resignation which will be effective 1 January. He is reported in the London Times to have declared that he cannot work with the funds available.

Air Commodore H.L. Roxburgh, Consultant adviser in aviation medicine at the RAF Institute of Aviation Medicine at Farnborough, has been appointed Professor in Aviation Medicine there on the recommendation of the Royal College of Physicians of London. This is the first professorship awarded to an RAF medical officer. The appointment follows a decision to increase both the extent and the standard of training in aviation medicine of RAF medical officers. Seven-month courses are to be held at Farnborough, and a new designation - "flight medical officer" - will be used by successful students.

Dr. Daphne Jackson, lecturer in physics at the Univ. of Surrey, has become the youngest Fellow of the British Institute of Physics. She worked for a year as a Research Assistant Professor at the Univ. of Washington, Seattle.

Dr. Brian Warner, a research fellow in the Dept. of Astrophysics, Oxford Univ., is to leave for the US next year to join the Macdonald Observatory team studying Mars in preparation for a landing on that planet.

Dr. D. Brandon has taken a position as Associate Professor in the Institute of Metals, The Technion, Haifa, Israel.

Prof. B.A. Bilby has formed a new department - Theory of Materials - in the Faculty of Metallurgy, Sheffield Univ. With him are Dr. J. Eshelby (Reader), Brian Gale, on leave from NPL, and two senior research fellows. An MSc program will start next fall.

Prof. E.M. Wright, Professor of Mathematics at the Univ. of Aberdeen, has been appointed Principal of that University.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office Box 39, Fleet Post Office, NY 09510.

ONRL-51-66 Psychology at the Technical University of Norway, Trondheim, by J.A. Rasmussen

ONRL-52-66 Services Electronics Research Laboratory 21st Anniversary Open Days, by P.D. Maycock

ONRL-53-66 Some Notes on Medical Education in Great Britain by I.N. Mensch (U LA, reserve training with ONRL)

ONRL-54-66 Some Solid State Physics in Basel, Freiburg and Strasbourg, by B.O.Seraphin

ONRL-55-66 Some Research in Materials in Birmingham, by J.B.Cohen

ONRL-56-66 Jet Engine Exhaust Smoke, by H.L.Seligmiller

ONRL-57-66 Studies in West Germany on Microwave Propagation and Scattering Over Water, by M.W. Long

ONRL-58-66 Psychology at Gotenborg, Sweden: The Institute of Education, The Psychotechnical Institute, by J.E. Rasmussen

The following conference reports are releasable to European scientists:

ONRL-C-28-66 XXth Plenary Congress of the International Commission for the Scientific Exploration of the Mediterranean Sea, by J.D.Costlow, Jr.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)
Office of Naval Research Branch Office
London, England 265000

2a. REPORT SECURITY CLASSIFICATION

2b GROUP

3. REPORT TITLE
(6) EUROPEAN SCIENTIFIC NOTES NO. 20-12,

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
N.A.

5. AUTHOR(S) (Last name, first name, initial)
(10) A Rasmussen J.E. [redacted] A Hewitson Victoria [redacted]

6. REPORT DATE
(11) 31 Dec 66

7a. TOTAL NO. OF PAGES
(12) 20 p.

7b NO OF REFS

8a. CONTRACT OR GRANT NO.
N.A.

b. PROJECT NO
N.A.

c.

d.

9a ORIGINATOR'S REPORT NUMBER(S)
ESN-20-12

9b OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
N.A.

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510

11. SUPPLEMENTARY NOTES
N.A.

12 SPONSORING MILITARY ACTIVITY
N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473 (b) (6)

UNCLASSIFIED
Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
MATERIALS SCIENCES MATHEMATICAL SCIENCES PHYSICAL SCIENCES PSYCHOLOGICAL SCIENCES						

INSTRUCTIONS

1. ORIGINATING ACTIVITY: Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. REPORT SECURITY CLASSIFICATION: Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. GROUP: Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. REPORT TITLE: Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. DESCRIPTIVE NOTES: If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. AUTHOR(S): Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. REPORT DATE: Enter the date of the report as day, month, year, or month, year. If more than one date appears on the report, use date of publication.

7a. TOTAL NUMBER OF PAGES: The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. NUMBER OF REFERENCES: Enter the total number of references cited in the report.

8a. CONTRACT OR GRANT NUMBER: If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. PROJECT NUMBER: Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. ORIGINATOR'S REPORT NUMBER(S): Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. OTHER REPORT NUMBER(S): If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. AVAILABILITY/LIMITATION NOTICES: Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. SUPPLEMENTARY NOTES: Use for additional explanatory notes.

12. SPONSORING MILITARY ACTIVITY: Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. ABSTRACT: Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. KEY WORDS: Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

Security Classification

AD NUMBER: AD0808825

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 28 Feb 1967. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

ESN-21-2

28 February 1967

Distributed by the
Office of Naval Research Branch Office,
London

EUROPEAN SCIENTIFIC NOTES
OFFICE OF NAVAL RESEARCH
LONDON

Edited by J.E. Rasmussen and Victoria S. Hewitson

28 February 1967 Vol. 21 No. 2

European Scientific Notes is Group II Newsletter type Class B periodical prepared and distributed by the Office of Naval Research London in accordance with NAVEXOS P-35.

(b) (6) [redacted]

C. T. FROSCHER
Captain, U.S.Navy
Commanding Officer

ONRL

Both ONR and its London Branch have recently celebrated their 20th anniversary. The editors of ESN considered this to be an appropriate occasion for a general article describing the history and present function of the London Branch. Dr. Peter King, who recently completed a period of service as Chief Scientist at ONRL, very kindly consented to undertake this task and has written the following paper.

ONR LONDON - THE NAVY'S INTERNATIONAL SCIENTIFIC EXCHANGE

The Office of Naval Research Branch Office, London, operates a unique service not only for the Navy but also for the broader American scientific community. The professional staff of ONR London, which includes Navy officers as well as civilian scientists, provides a direct link between European and US scientific research. Through regular visits to scientific and technical establishments in Great Britain and Europe and through attendance at international scientific meetings, ONR London personnel maintain communication pipelines which provide a steady two-way flow of information on scientific progress between this country and abroad.

ONR London, like its parent, ONR Washington, is a descendant of the World War II Office of Scientific Research and Development, which during the war forged a new partnership between the Federal Government and the American scientist. The success of OSRD stimulated the Navy to establish its own permanent organization which would continue this partnership and insure the technological evolution of the Navy beyond the end of the war. The Navy was considerably aided in this effort by the publication of Vannevar Bush's influential report, "Science, the Endless Frontier," in July 1945 in which he urged that government support and participation in science be continued beyond the end of the war. The Office of Research and Inventions, which had already been set up by the Navy in May 1945, was transformed by Act of Congress into the Office of Naval Research in August 1946 when it became the first Federal agency with the primary mission of supporting scientific research.

The need for international exchange of scientific information was also noted by Dr. Bush in his report. He stated that "increasing specialization of science will make it more important than ever that scientists in this country keep continually abreast of developments abroad." This was spelled out even more cogently by the Steelman Report, "Science and Public Policy," published in 1947. This report stated: "Even when conditions of free scientific publication exist, there is often a considerable time lag between completion of the research and publication. Moreover, it is important that research workers be aware of similar or overlapping interests at an early stage in the work in order to make plans for cooperation or for cross-checking results."

As it happened, OSRD had established a London Mission in 1940 for the exchange of war research information. It was logical to continue this function under ONR. In fact, the jurisdiction of OSRD London was transferred to the Navy in March 1946 before ORI had become ONR. The transition was made even smoother when Dr. Holbrook M. MacNeillie, who had headed the OSRD London Liaison Office, was appointed the scientific director for the new Navy London office. The first Commanding Officer following him was Commodore Robert E. Robinson, Jr. The Commanding Officers following him were Captains James P. Clay, Phillip D. Lohmann, Phillip S. Creasor, Bernard H. Meyer, Bradley F. Bennett, John K. Sloatman, Jr., William W. Schaefer, and the present incumbent, Captain C.T. Froscher.

The scientific directors who followed Dr. MacNeillie were Drs. Daniel B. Clapp, Charles E. Sunderlin, Maurice E. Bell, Samuel R. Aspinall, Gerard F.W. Mulders, David M. Gates, Howard E. Page, Immanuel Estermann, Peter King, and the present incumbent, Mr. Aubrey Pryce.

The initial objective of ONR London was to collect information on European research. Its mission, as originally stated, was to establish and maintain liaison with all scientific research agencies in free Europe and adjacent areas outside the Iron Curtain in order to keep the Navy Department, and especially the Chief of Naval Research, informed of all scientific endeavors in those areas.

Right from the start ONRL realized that it must develop an image of a truly scientific activity rather than an intelligence arm of the US government. Such an image was of crucial importance to the success of its mission.

A key element in achieving this success was the establishment of a policy of employing scientists highly respected in their fields. About 12 members of the professional staff are civilians from academic positions of the rank of full or senior associate professor or from government positions of corresponding professional standing. About 60 percent of this group are from universities and non-government research agencies. In most cases they have already established reputations in Europe, which gives them ready access to the academic community of Europe. Since they are not associated with military activities, they are in a good position to have a free exchange of scientific information with their colleagues. The remaining 40 percent of the civilian staff comes from ONR or other government activities. In addition, there is now an eleven-man military contingent. All of these officers have graduate training in various technical fields and two hold a PhD degree.

None of the civilian scientists remains for more than two years, with the usual stay from one year to 18 months. This rapid turnover is deliberate to permit the hiring of outstanding professors who can stay away from their universities for only one academic year plus two summers. The usual practice is to accept employment at ONRL during a sabbatical. Another reason for the short-term employment is that ONRL wants scientists who are actively engaged in research. If such scientists remained away from their work for an extensive period, they would be removed from the main stream of research in their fields and their effectiveness in the exchange of information would rapidly decrease.

The qualifications for a scientific officer on the staff of ONRL were probably best set forth by Dr. C.E. Sunderlin, one of the early scientific directors of ONRL. As Sunderlin describes him, the successful scientific liaison officer must, of course, be competent in his own special field. This means he must have intimate knowledge of all important research in his field in the US, for otherwise he cannot judge the importance and timeliness of research in Europe. He must possess sound judgment as to the relative importance of new developments. Sunderlin saw the scientific liaison officer as a man riding twin horses -- eager to do research himself but confining himself for the moment to the research of others.

In the early years of ONRL the work of the office centered on Great Britain. This was due not only to the fact that it took over the work of the OSRD London Mission but also because Great Britain, unlike most of the European countries, had not been occupied. Many of its research laboratories continued important fundamental research in spite of night bombing, V-1's and V-2's, and the rigors of war. Research work rapidly assumed a peacetime character in the UK, and university enrollment practically doubled during the first three postwar years.

Gradually, however, the other countries of Western Europe rebuilt their programs of fundamental research and began to restock their supplies of scientific and technical knowledge and personnel. National scientific organizations began to appear in these countries. In France it was the Centre National de la Recherche Scientifique (CNRS). Belgium, Holland, Italy and Spain established similar organizations.

German science was a special case. It had to be revitalized under military government and within the restrictions of inadequate laboratories, libraries and personnel. Nevertheless, ONRL discovered that in the early postwar years five to ten thousand scientists in Germany were engaged in some kind of research, and that the results of this research were largely unpublished. Such research would have gone unnoted for a long period without the scientific liaison work of ONRL.

European science made a remarkably rapid recovery and by the early 1950's was back on its feet. It was now ready and eager to absorb data on US research. This meant that ONR London not only had to collect material but also impart information on American progress to the European scientific community as well.

This made the ONRL scientific staff even more welcome when they visited European institutions and laboratories.

Several years ago when the Mutual Weapons Development Program was initiated, ONRL was given an additional assignment. This was to provide a contact between the laboratories of the British and other military establishments and the Navy's research and development programs. ONRL established a Naval Applications Section staffed by technically trained naval officers to carry out this function. They have become the major liaison between the Navy and European defense establishments. A certain amount of the time of these officers is spent on assisting with the administration of US overseas research and development programs. In addition, they often act as US observers or members on NATO committees or in other international negotiations.

The principal reason, however, for the existence of ONR London and the major focus of its attention is the scientific exchange program. ONRL has developed a technique which is as far removed as possible from the bureaucratic way of doing things. Everything is based on the personal touch.

The ONRL scientific liaison officer, as indicated earlier, obtains information by visiting laboratories and attending scientific meetings. In a year, approximately 300 laboratories in Europe are visited by the ONRL staff. The amount of time spent on visits to laboratories depends on the needs of the Navy and the energy of the scientist. Actually, he spends between 30 and 40 percent of his time in attendance at meetings and visiting laboratories outside the London area. While in London, in addition to his necessary routine correspondence, he prepares his reports for transmittal to scientists in the States, visits the local university and government laboratories and attends local scientific meetings and university seminars.

About 270 cities outside of London have been visited at least once. Eleven cities receive the bulk of the visits, with the greatest density in Great Britain. In addition to the major Western European countries, ONRL scientists visit the countries of southeast Europe and the Middle East as far as Israel. They also visit Poland, Czechoslavakia, Rumania, Yugoslavia, and Russia. They come to call on the individual European scientist, not to visit the institution where he happens to be employed. The ONRL visitor makes it plain that his activities are in no way covert and that the information he receives will be reported to the US Government and scientific community only and will not become part of the scientific literature. This conforms to the ethics of scientific reporting which follows the rule that the communication of scientific results for the purpose of publication can properly be done only by the research scientist himself.

When an ONRL scientist obtains information which he believes is of value to the scientific program in the Navy, he reports his findings in a variety of ways, depending upon the nature of the information. In some instances a letter will be sent to individual scientists, especially within ONR or to the Navy laboratories. When he wishes to send information of specific interest to a small group of specialists in the area, he may prepare a Technical Memorandum which goes to approximately ten addressees. This form may also be used to fulfill a specific request of one of the Navy technical groups or contractors. Usually about 40 or 50 of these memoranda are issued per year.

If the information is of much more general interest, such as to all those involved in the metallurgy program of the Navy, the more formal Technical Report is used, which might receive a distribution of two or three hundred copies. Examples of these reports are, "The UNESCO International Conference on Radioisotopes in Scientific Research" and "Zoology and Physiology at the University of Bergen." The number of these reports averages about 150 per year and has been quite constant since 1950.

Finally, material which is of general scientific interest is published in the inexpensively produced <u>European Scientific Notes</u> issued 10 to 12 times per year. This highly readable publication, which is as informal as two scientists chatting

over a cup of coffee, has steadily increased its circulation in recent years, a significant indication of the major service performed by ONR London for the American scientific community. In 1955, this publication went to about fourteen hundred addressees. Presently ESN goes to over 7,000 individuals in government agencies and research laboratories, ONR contractors and scientists in the US. The publication is not distributed to the press in order to prevent reprinting or dissemination of the material contained in it beyond the scientific community. Each issue carries a statement that the material is "not part of the scientific literature."

ESN, which contains a minimum of ten scientific articles in each issue, has been edited for some time by Victoria Hewitson and a scientist on the London staff who takes on the duty for six months at a time. There is no question that it contains valuable scientific data and shrewd analysis of European research capabilities available in no other publication. As a check to see whether ESN is consistently useful to its recipients, a survey was made a few years ago in which each recipient was required to state whether he wished to continue receiving it. More than 96 percent of the addressees replied in the affirmative.

One reason for the popularity of ESN is that ONR London is the only agency of the US Government engaged in foreign scientific liaison on such a broad basis. The State Department science attache office in any given country is not generally staffed with a large number of experts in various scientific fields, and in addition they are somewhat restricted by national boundaries, which limits their detailed scientific coverage. The overseas offices of the other military services do not engage in scientific liaison of the same nature and scope as that provided by ONR London. There has been no need since all of these agencies receive the reports from ONRL.

In addition to the reports prepared by the ONR London staff, the office transmits to the US copies of scientific documents published in Europe. About 2,500 titles per year are sent, although only a few copies of each report are distributed. About 75 percent of these documents originate in the UK, with other countries providing only a very small number. The reason for this is that the research report appears to be an Anglo-American invention and has not yet been adopted on a large scale by other countries.

Expediting the flow of technical information from the US to Europe is an equally important function of ONRL. Many of the European publications available to ONRL for distribution to the US are being received in exchange for US documents distributed by ONRL. Moreover, the American documents serve as an "admission ticket" to European laboratories and facilitate the acquisition of the scientific information which forms a basis for the compilation of ONRL's own technical reports.

About 7,000 research reports are received by ONRL each year from ONR contractors and a number of other government agencies. These are generally technical and annual reports which the scientist has prepared for the agency which sponsors his research, and other reports which the responsible agency considers appropriate for European distribution. Since an average of 15 copies of each report is sent, this means that ONRL receives more than 100,000 documents a year for distribution to European scientists. Only a small fraction of this number is sent to a routine distribution list. In the great majority of cases each report is scanned by an ONRL scientist who determines its distribution on the basis of his knowledge of the scientific interests of the recipient. Often these reports are sent to scientists who the ONRL liaison officer knows will have immediate use for the information because of its relationship to the research they are conducting. Such personal and timely distribution of information is greatly appreciated by European scientists and is a major factor in the large amount of good will built up by ONR London. ONRL also handles requests from European scientists for specific reports referenced in the publications they have received. In one year 300 requests for reports were received from European scientists and virtually all were filled.

ONR London also assists scientists working under the ONR program in their visits

to Europe and European laboratories. This aid takes various forms such as suggesting laboratories of interest and assisting in making appointments. Many other scientists find it of value to discuss with staff members their plans and to exchange information on research activities in Europe. These visits are welcomed by ONRL. Where possible, the same kind of assistance is given to European scientists planning to visit the US. In effect, ONRL has become a focal point for American scientists visiting Europe and vice versa.

ONR London also operates the Navy European Patents Program, administered by a Patent Counsel who can act for Navy systems commands and offices on patent matters arising in Great Britain and other European countries in connection with their foreign programs. He also advises on requirements and procedures in accordance with the laws of the various countries. This involves evaluating patent disclosures from contractors who have made inventions during the course of their work and liaison with officers of foreign governments regarding the security classification of patent applications filed in foreign countries. The Patent Counsel also receives and screens disclosures of inventions submitted by foreign inventors and assists interested agencies in negotiations with such inventors.

Although ONR London does not operate like any other ONR branch office and is separated from ONR Washington by 3000 miles of ocean, it does not work in a vacuum. ONR London has already responded to the increasing emphasis in ONR of supporting research which has direct naval relevance. Until a decade ago, ONRL was interested almost exclusively in basic science, since European scientific research is most important in basic and fundamental areas rather than in engineering and development. Now ONRL is giving increased attention to more immediate naval developmental programs. This actually began about 1955 when ONR London was assigned the responsibility for monitoring the MWDP weapons development programs under Navy cognizance and the Naval Applications Division was established. The officers who carry out this function also represent the Chief of Naval Operations and the material commands.

As ONR London became more involved with reporting on applied research and development in addition to basic research, its usefulness to Navy laboratories and the material commands became more apparent. It was also obvious that to fulfill this function ONR London must have on its staff officers and civilians with a broad range of technical and scientific specialties. This led to a new recruiting program established in 1965 by the Secretary of the Navy, in which scientific and technical personnel (GS-14 and above) throughout the entire US Government inhouse R&D community were encouraged to apply for short-term employment (one to two years) at ONR London. It is believed that this program will not only provide career development opportunities for laboratory scientists and engineers to enhance their scientific potential, but also will benefit their parent organizations and the Navy. (Employees remain on the rolls and payroll of their parent organizations and return there upon completion of their tour in London.) The background of personnel hired in this program ranges from basic research to systems engineering. ONRL now has on its staff scientists whose background will permit them to devote their time to such fields as power and fuels in all their applications, vehicles and missiles, underwater acoustics and its relation to undersea warfare, and electronics particularly as applied to weapons, weapon systems, infrared and radar. When Peter King was appointed chief scientist for ONR Washington last August after serving two years as scientific director for ONR London, his replacement was Aubrey Pryce who has served for the past several years in the Naval Applications Group in ONR Washington.

The interest of the US in European science has certainly not abated. In certain areas European laboratories have clearly demonstrated superiority, both in talent and facilities. Therefore, ONR London can be expected to maintain its value as a scientific listening post. Science magazine, recently describing the operation of ONR London, stated it this way:

> "The very vitality of European science today puts ONR London's services at a premium, since in practical terms it is impossible to assess scientific developments from a vantage point 3000 miles away."
>
> (Peter King)

MATERIAL SCIENCES

FUEL CELL DEVELOPMENT AT VARTA AGmbH

Varta, one of the world's largest battery manufacturers, produces all types of batteries, from the smallest sealed Ni-Cd to giant propulsion lead-acid systems for trains. (Over 300 German trains are powered at 120 km/hr with a 200-km range by Varta batteries.) Annual sales for Varta are about 300 million DM (1 DM = $0.25). Their new central research laboratory at Kelkheim (30 minutes by rail from Frankfurt), headed by Prof. H. Bode, was opened formally in September 1966. The laboratory's 225 employees are doing research on Ni-Cd batteries, alkaline batteries, MnO_2 batteries, and fuel cell systems. The laboratory is ultramodern with an abundance of expensive, sophisticated equipment competitive with anything the US has to offer.

The fuel cell program is headed by Dipl.Ing. F. Wehrse (an engineer with aircraft industry experience). Fuel cell research began here in 1959 with a small group which explored fundamental electrode processes in conjunction with various academic efforts. In 1961, the group moved to some Varta facilities in Kelkheim and involved 25 persons covering virtually all fundamental aspects of fuel cells. In 1963 the research began to concentrate on low-temperature low-pressure 6N-KOH cells with nickel-nickel silver electrodes. Now, in 1967, the program has 90 people in three departments, Research, Development, and Production, at the new research laboratory and nearly 50 persons at the pilot production facility. The Research Department, headed by Dr. Hans Von Döhren, has about 25 people, as does the development section. The remainder are involved in electrode fabrication and systems engineering and assembly.

This fuel cell program is unique in many ways. First, Varta feels it must support fuel cell research as a defensive means to protect its position in the battery business. R&D funds for fuel cells come "off the top" as a corporate levy. Second, the technological base in advanced electrochemistry, materials fabrication, and packaging technique make the fuel cell studies a natural. Third, the heritage obtained by collaborating with Prof. E.Justi and Dr. A. Winsel (Inst. for Technical Physics, Braunschweig) and with Prof. Dr. H. Gerischer (Physical Chemistry and Electrochemistry Inst., Technical High School, Munich), along with information exchange with Siemens, give Varta a technological base that is hard to exceed.

Varta's existing systems are based on the popular DSK electrode system developed by Justi and Winsel (Winsel is now with Varta). A detailed discussion of the company's electrode structures and chemistry was presented at Brighton in September 1966 (M.Jung & H.H.Von Döhren, "A contribution to the production of Raney nickel anodes for fuel cells," 5th International Power Source Symposium, Brighton, 20-22 Sep 1966, Pergamon Press). The electrodes are now rectangular and are either "one postcard size" (about 4 in x 7 in) or "two postcard size" (8 in x 7 in). The H_2 electrodes use Raney-nickel alloys which are activated and rendered non-pyrophoric by a proprietary treatment of the powders before pressing and sintering. (The three-layer nickel electrode consists of: a fine pure layer which is Mond nickel with low density 0.35g/cm^3, the working layer with preactivated Raney powder mixed with Mond nickel and sodium carbonate filler and the Mond nickel-potassium chloride filler gas distribution layer.) The silver catalyzed oxygen electrode uses Raney nickel and 16-18% silver by weight. This is effectively 100-mg silver/cm^2 of electrode. The present modules incorporating these materials are price-competitive/unit area with sintered Ni-Cd electrodes. This represents a major improvement in electrode economics. The preactivated electrode system gives 200 mA/cm^2 at room temperature over the large areas discussed. Copper-promoted electrodes have performed at 100 mA/cm^2 for more than 4000 hours. Varta's present electrode production capability is 1000 "postcard" electrodes per month. In addition to the work on fuel cell electrodes, advanced structures for hydrogen production by selective diffusion from reformer gases at temperatures below 40°C are being developed. Also, cells for the hydrolysis of H_2O are under life test.

Varta's present modules use ten cells of the "one postcard" electrodes in an alumina-filled epoxy supporting container. These modules weigh 33 kg/kW of power out. Table 1 shows the

progress in module energy/unit power and volume/power.

TABLE 1

"Typical Units"

Year	Characteristics	Electrode Shape
1957	0.5-W feasibility	circular
1962	500 kg/kW	circular
1963	142 kg/kW 121 liter/kW	circular
1965	87 kg/kW 31 liter/kW	circular
1965	68 kg/kW 19 liter/kW	3"x5" rectangular
1966-67	33 kg/kW: 14 liter/kW	about 4"x7" rectangular

Several systems were being built or tested, ranging from a 0.2-W buoy power-source to operate for two years unattended to 2-5 kW units for fork-lift trucks. Some systems are:

0.2-W buoy power pack: This H_2-O_2 system uses bottled fuel (two tanks, 6 in diameter x 24 in long), a $\frac{1}{4}$ ft^3 KOH reservoir and a two-cell fuel cell operating at about 3 mA/cm^2 (therefore very efficient!). No other system can do the job, claims Wehrse. Several of these buoy systems are now on order from the German Navy;

Nominal 300-W H_2-O_2 system (will be - Air): Two were being tested when I visited. These are for silent power for the German Army. They appear well engineered and are neatly packaged in an 8-ft^3 box weighing 85 kg. No attempt was made to pack the system tightly, and there is room for several modules to be added. Varta has perfected new pumps, valves, and other auxiliaries in their engineering program. One interesting feature is the slide-rack mounting of this system so that it can be pulled out of its case and repaired;

100-W Methanol-O_2 system (will be - Air): This system has a new proprietary electrode which utilizes the methanol directly. The package is about 2 ft^3, complete with fuel;

Nominal 2-3 kW System (7-kW peak): This system fits the space for a battery in a heavy fork-lift truck and uses bottled H_2-O_2. It has 32 ten-cell modules with "one postcard" electrodes. Approximate dimensions are 14 in x 24 in x 36 in.

The results of extensive research on fuel sources for H_2-Air systems were clearly demonstrated by several operating prototypes.

Ten 3-in diameter circular cells were generating 40 liters/hour of H_2 and had been operating for 3000 hours without degradation. No special explosion precautions were taken in system plumbing. The package was about 1 in x 4 in x 8 in. This cell was using the new preactivated electrodes described in the above reference. The hydrogen produced is ultra-pure and can therefore be used by the fuel cell systems directly.

A hydrazine-to-hydrogen converter using a porous copper, Raney nickel-copper electrode was working at 900 liters/hour with the module volume being 2 in x 4 in x 8 in. Water cooling was used in the laboratory model so that external dimensions with cooling fins would be greater.

One serendipitous result that excites Varta very much is the use of their electrodes in the Chlor-Alkali chemical process to tap off electrical power. Experiments indicate that more than 20% of the power required by this process can be reclaimed. Economic analyses have them and a customer convinced that this should be tried on a much larger scale. Perhaps all of their fuel cell research will be justified by the fruits of this one application.

The Varta fuel cell program is now maturing to the point where the next two to three years will see corporate decisions being made on mass production of fuel cell systems. The probability of success appears high. Potential applications are carefully screened by battery-wizened management, but all signs indicate a "go" situation.

(P.D. Maycock)

CARBON FIBERS FOR FUTURE REINFORCED PLASTICS

The Royal Aircraft Establishment (RAE) at Farnborough, England has taken a position of leadership in production of carbon fibers which, it is hoped, will ultimately find use as the reinforcing material in wound or fabric laminates. The RAE fibers consist of tiny crystallites of graphite bonded together so that each individual fiber has a diameter of about 6 μ (0.00025 in). Since graphite crystals have a very strong "a" axis, but are relatively weak in the "c" direction, the trick is to control fiber production so that

the crystallites have their "a" axes parallel to the fiber axes.

At present fibers can be made only in discrete lengths, produced by a batch process. The RAE is confident that the technology for production of continuous filaments, which they have under development, will be ready in a few months for pilot trials by manufacturers. The essential features of the fiber technology have been protected by patents. The latter are assigned to the National Research Development Corporation, Kingsgate House, 66 Victoria Street, London, SW 1, an agency of the British government charged with the mission of stimulating commercial applications for new developments. Manufacturers who can make carbon fibers by the batch process are:

Courtauld's Ltd.
Lockhurst Lane, Coventry;
and
Morganite Research & Development Ltd.
Battersea Church Road
London, S.W. 11

Mr. William Watt, Chemistry, Physics and Metallurgy Department, leads the carbon fiber research at RAE. Watt furnishes the following representative properties of individual fibers as compared with glass:

	Glass Fibers	RAE Carbon Fibers
Specific gravity	2.54	2.00
Tensile strength (psi)	250×10^3	300×10^3
Young's modulus (psi)	9×10^6	60×10^6

Recent work has shown that mechanical properties can be changed by varying heat treatment. A peak appears in the curve of tensile strength plotted against treatment temperature, at about 1500°C. Fibers treated at this temperature are giving a breaking stress of about 450×10^3 psi. Since Young's modulus increases with temperature in an approximately linear manner, fibers treated at 1500°C are less stiff with a modulus of 32×10^6. An article on Watt's newest research will be published soon in Nature.

It is clearly apparent that carbon fibers have demonstrated superior strength in the laboratory. Considering the lower specific gravity, compared to glass, prospects of reinforced structures with superior strength-to-weight ratio may be envisioned. Yet to be demonstrated, however, is the practical combination of continuous filaments in a suitable plastic matrix. A huge technological effort lies behind the present state of the art which has introduced glass fiber materials into everything that moves, from skis to space ships. The techniques devised by the glass industry may or may not be applicable to carbon-reinforced materials. (D.C. Hornig)

MATHEMATICAL SCIENCES

INTERNATIONAL COMPUTERS & TABULATORS (ICT)

ICT is Britain's largest computer manufacturer, commanding 40% of the British market. The company is undergoing dramatic transition as its punched card equipment is phased out and its new 1900 series of compatible computers (announced Sept. 1964) is brought in as a new major product. The 1900 range includes seven basic computers and a comprehensive collection of storage, input, and output equipment. The series has a 6-bit character bed with 24-bit binary words and has a standard interface. The machines are not compatible with IBM 360's. Typical systems range from a lower price of about £40,000 to an upper one of £750,000. One price-conscious version of the 1901 for smaller businesses can cost as little as £20,000. Over 650 of the 1900 series computers have been ordered with more than one-third slated for export. Last year's ICT sales (year ended 28 Sept 66) were £63.4 million, and profits were £2.22 million, before tax. This compares with a loss for the preceding year. Considerable Government encouragement has been given ICT. Over £250,000 have come from the Ministry of Technology under the advanced computer technology program. ICT also has a £5 million loan for R&D from the National Research and Development Council, and a £5 million credit guarantee from the Export Credits Guarantee Department appears certain. The latter funding will partially eliminate the financial stress caused by changing from direct sales to some rental in the 1900 series. This credit can only be used for export machines. It remains to be seen where sufficient capital will be obtained to allow mass rental of the

1900's in Great Britain. Success of ICT in the next two years depends significantly on generating enough reserve capital to allow this transition from direct sales to rentals.

ICT's recent rise as a major British computer manufacturer is mainly due to the know-how derived from its acquisition or control of EMI and a part of Ferranti. Ferranti's Computer Division had collaborated for years with Manchester University. The collaboration first generated the Mark I, the first stored-program digital computer ever built for sale by a manufacturer. Then followed the floating point Mercury, Pegasus, Sirius, Orion, Argus, and Hermes. The Ferranti Atlas, the culmination of 12 years of collaboration, was and is one of the most powerful computing tools in the world, because of the entirely original approach taken in its design and the technical innovations which made the approach possible. Most important is a supervisory system which automatically regulates the flow of work through the machine. The Atlas invoked advanced store technology and store allocation. Coupled with high-speed circuits, a million operations per sec were obtained. Some 200 jobs may be in the system at any one time, and a typical installation costs £2 million. An improved version of Atlas II was evolved at Cambridge.

At this point it seems pertinent to question why this Atlas technology, supposedly the most superior computer in the world, did not immediately place Ferranti in a position of world leadership in computing. Perhaps one clue lies in visits made by the authors to the Atlas computing centers and the new non-Atlas centers at various British universities. There seemed a strong tendency to denounce a competing Atlas or to denounce the Atlas program in general. Comments like "their tanks leak," "their compiler never ran," "their machine is always down," are indications of the attitudes which pervade the Atlas story. However, not to belabor this, we believe that Atlas suffered from several key problems: 1. It was oversold and ballyhooed with a blare of trumpets; 2. It suffered from inadequate Government funding to provide the peripherals required to make the centers truly useable; 3. Intense academic freedom lessened cooperation between software academics so that a British computer language did not develop.

In any case, ICT acquired much technological know-how from the Ferranti-Manchester team, and after several years of marketing RCA 1500's and Univac 1004's with ICT labels, it is now ahead of the British pack with the 1900 series. Of course the English Electric's highly successful KDF9 and its new Series 4 keeps the competition keen.

ICT research is centered around its two major groups: The Data Processing Equipment Group at Stevenage and the Computer Equipment Group at West Gorton, Manchester. The former is responsible for the production of the smaller, 1901, 02 and 03 computers as well as printers, card readers and peripherals. The latter group is responsible for the production and development of the 1904, 05, 06, 08 and 09 computers. Each has its own R&D laboratory. A visit was made to the Stevenage lab directed by Mr. P.G.Briggs, and some of the research will be covered in detail. As the West Gorton lab was not visited, second-hand information obtained from ICT professionals in the London headquarters and at Stevenage will be reported.

The advanced R&D laboratory headed by Briggs has 45 people in two sections, Physics and Engineering. Physics projects include high density recording (involving plated wire stores, enhanced disc devices, thin metal films), and support of the microwiring project. Engineering has four main projects: microwiring, multilevel storage, fluidics, and metal-oxide-semiconductor (MOS) technology. The most important is the microwiring project, which is ICT's answer to LSI (large scale integration). On a 2-in x 1-in alumina ceramic substrate, 50 silicon chips, with at least four gates each, are to be interconnected with up to four layers of conductors. The present system uses Emitter Coupled Logic (Motorola chips). The alumina substrate is first given a metal interconnection pattern, a layer of glass dielectric is applied, then a silk-screened metallized ground plane layer. The next dielectric is organic, and so on, until an interconnection matrix is built up. Between-layer connections are made by leaving holes in the dielectric and vapor depositing metallic bridges from one layer to another. After the interconnection matrix is complete, 50 tested chips will be ultrasonically bonded to the metallized pads. No working arrays

using the above technology have been produced yet, however, they expect success in a few months. This unusual mix of evaporation, silk screening, etching, glass and organic dielectrics may actually generate problems in this simple approach which are not yet appreciated.

Despite this present interest in next-generation devices, ICT computers now use outside components (US and British), and the improved 1900's with monolithic IC's will also be from outside vendors. The long-term order of preference for component suppliers is: (1) UK; (2) Europe; (3) US companies in Europe; (4) US companies. However, short-term purchases depend on availability and economics. The present research at Stevenage and, reportedly, West Gorton, is aimed at a generation five or more years hence.

Another project described in detail was Fluidics, which attempts to understand and make useful fluidic devices for ICT's interests. One device is an array of fluidic (gas) switches which are used as a contactless punched card or paper tape reader. Prototypes seem to be less expensive and more reliable than mechanical equivalents. The essence of this program is discussed in the following papers:

"Electropneumatic transducer using the acoustic switching of fluid logic elements," by G.A.R.Benson & D.Hawgood, J. Science Instr. 43,pp. 527-28, Aug. 1966; "Electrical transducers for fluidic systems in computer peripherals," by D.Hawgood, presented at the 2nd Cranfield Fluidics Conf., 3-5 Jan 1967, Cambridge, Paper No.F-3; and "Steady state and dynamic characteristic variations in digitel wall attachment devices," by D.R.Steptoe, ibid, Paper No. B-3.

The West Gorton group, derived by the acquisition of a section of Ferranti, continues to have much interaction with the Ferranti labs at Bracknell. The R&D at West Gorton was reported as very advanced and aiming at a next-generation computer involving arrays of monolithic circuits, strip-line multi-layer boards (automatically produced with computer-generated interconnection paths), and a fundamental circuit element involving about 60 gates. This computer (called BASIC within the company) has been developed over four years and built in the last one and a half years. An experimental system is reportedly ready for testing, and involves a new way of indirect addressing and a radical change in the address structure. Indications are that Electrical Engineering, Manchester, is again collaborating on this and that the 1970+ requirements of the National Computing Centre and the London Univ. Regional Centre might well be met by a giant British billion-bit machine using this technology. These are only inferences derived from statements, awful silences and gleams in eyes. It is a fact that a British giant machine has been proposed and is being worked on. All evidence indicates probability of economic success to be small but finite.

The ICT Planning Group, Putney House, London, headed by Mr. D.Eldridge, was visited. Some sections discussed were: (1) Market Planning, which is involved in the definition of future products to meet market requirements and the strategy of product launching, etc. (2) Software Planning - This section has grown to 800 persons in three years, of whom 700 are programmers. In the last 18 months more attention has been given to planning and standardization within the Department itself in such areas as COBOL programming, tape housekeeping and documentation. (3) System Development Operation - This group of 500 is developing a wide range of operating systems. Eight hundred programs are involved. Multiaccess system work is in evidence with 16 people working on multi-on-line programming. Simulation on the 1900 series is being used to obtain operating characteristics of software. This will be helpful in developing a MAC-type system with on-line users and background jobs involving interactive compilers with conversational modes. This simulation will be based on the 1906-7, of which 15 have been sold. However, the group emphasizes software for the 1900 series in general. This build-up in software at ICT has been very rapid, and reflects an increasing recognition of the importance of good software. The company does not favor sub-contracting in software.

Areas of future interest are the software for a random access system, the development of a realtime operating system, and an integrated management information system. Linear programming, PERT and Sketchpad work are also under way. Languages of interest to ICT are: COBOL, FORTRAN, ALGOL, MICOL (A small, simple commercial language which can easily be learned by experienced punchedcard users),

Rapidwrite (for business), CSL and APT. (Notably absent is PL-1.)

In conclusion, ICT is certainly a modern, well-managed, high technology company, working successfully in a very competitive field. It seems to be covering all aspects of its business with endeavor adequate to continue to be competitive. (Paul D. Maycock, J.W. Hemann, and J. Cowie of the US Naval Postgraduate School, Monterey, Calif.)

MECHANICS

MECHANICS OF BONES IN SWITZERLAND

Early in 1958, fifteen Swiss general and orthopedic surgeons joined together to re-examine the common procedures then in use for the operative treatment of fractures. This group formed the Association for the Study of the Problems of Internal Fixation. Most of the initiative for this undertaking is due to M. Allgöwer, until recently chief surgeon at Cantonese Hospital at Chur. In July 1966 he was appointed to the chair of surgery at the University of Basel. Two other surgeons who took a prominent part in the development of the technique are M.E. Müller and H. Willenegger.

Quite early Allgöwer recognized that a purely clinical activity employing such a new technique was not sufficient to guarantee success and that it had to be backed up by rigorous basic research removed from a hospital. His attention was drawn to the Davos Research Institute. This Institute was founded around the turn of the century, at a time when Davos was one of the world's largest centers for treatment of tuberculosis, with the purpose of conducting research in this field. After WWII, however, with the advent of antibiotics, most of the sanatoria in Davos were converted into hotels, and the activities of the Institute receded to practically nil. Allgöwer conceived the idea of using the facilities of the Institute for the purposes of research on bones. He was successful in obtaining a number of research grants, both from the Swiss government and the US National Institutes of Health. By now, however, the Institute is practically self-supporting. The major part of its income derives from licensing and patent fees for the special sets of instruments which Allgöwer and his collaborators developed and which are now produced commercially. This income, amounting to almost $100,000 per year, could have been used privately by Allgöwer, but he chose to support the Institute instead. At the present time the Director of the Institute is M. Fleisch, who is a physiologist and who has lectured several times in the US.

One of the important sections of the Institute is the documentation center. For each case of internal fixation of a fracture in Switzerland and several other European countries, a code sheet is completed after the first discharge from the hospital and sent to Davos with X-rays taken before and after the operation. Based on this first code sheet, two cards are punched, and reduced prints of the X-rays are pasted on the back of the cards. One of these cards is returned to the surgeon and the second remains in Davos. After four months another code sheet and new X-rays are sent by the surgeon to Davos. Copies of X-rays are fixed to the punched card and one of the two cards with the original X-rays is returned to the surgeon. After the one-year follow-up, a final code sheet is completed on the assumption that the case can now be closed. If it cannot, the surgeon makes a note that an additional examination will be required after another six months.

The card file at Davos now contains over 8,000 entries and this documentation has proved very useful over the years in correcting mistakes. In the fall of 1966 a full-time statistician will be employed by the Institute to make full use of the available material.

Another project concerns artificial growing of bone tissue, and a study of the various effects which may influence growth rate.

Considerable attention is given to studies of strength of bones and implants. A large series of experiments on sheep have been carried out by S. Perren, which involve attachment of strain gages to the bones *in vivo* and also the attachment of strain gages to implants. A striking movie strip, which was shown to the general public recently as part of Swiss newsreels, shows a sheep whose fractured femur was fixed with an implant. Right from the operating table the sheep runs out into the meadow and starts grazing without any signs of discomfort.

In using implants for treatment

of fracture of bones, it was recognized that metallurgical problems associated with the implant material are of utmost importance for developing a successful technique. Of particular significance are the different types of corrosion of metals. Allgöwer, several years ago, established a joint research and manufacturing program with the Laboratory of Metallurgy of R. Straumann in Waldenburg (near Basel), Switzerland. This laboratory is located in the watchmaking part of Switzerland, and originally Straumann was a metal technician at one of the local firms. He was very successful in developing certain alloys for watch springs, became independent and founded his own laboratory, which is financed by the income from his own patents and licenses. The laboratory is located in a brand new spacious building and is extremely well equipped and staffed. In addition to metallurgical work, the laboratory pursues questions of bearing design for watches and fine instruments, manufactures specialized testing equipment and also does some work in ultrasonics.

S. Steinemann, a physicist, is primarily responsible for the metallurgical research on implant materials. The material for implants used so far is a type of austenitic stainless steel, but Steinemann is planning to consider titanium alloys in the future. He also plans to construct an instrumental model of a complete skeleton to study the stress distribution in various bones when the human body is subjected to various loading conditions. Some of his recent research dealt with metallosis. (F.Straumann, S. Steinemann, O. Pohler, H.Willenegger and R. Schenk, "Neuere experimentelle und klinische Ergebnisse über die Metallose," in Langebecks Archiv vereinigt mit Deutsche Zeitschrift für Chirurgie, 305, No. 1, 1963, pp.21-8; 1. Tagung der Deutschen Gesellschaft für plastische und Wiederherstellungs-Chirurgie, April 20, 1963.)

The whole technique of internal fixation of fractures is described in detail in a recent book in English by M.E. Müller, M. Allgöwer and H. Willenegger. (M.E. Müller, M.Allgöwer and H. Willenegger, Technique of Internal Fixation of Fractures, Springer-Verlag, New York (1965).) (George Herrmann, The Technological Institute, Northwestern University, Evanston, Illinois)

ISRAEL AIRCRAFT INDUSTRY

Located at the Lod Airport outside Tel Aviv, the Israel Aircraft Industry is an outgrowth of an original overhaul facility, which is still an important function of the company. Currently employing about 4500, with about 180 engineers in R&D, the Industry has some capability in practically every aspect of airframe construction save in power plants. Some projects in the past have been to redesign the Boeing Skymaster to incorporate a swing tail and to equip it with new freight handling facilities suitable for aerial drop and to carry out some development and flight tests on a flexible wing airplane.

A current project is the complete design and production of a 12,000-lb turbo-prop civil airplane. The power plant will be purchased abroad. As there are no wind tunnel facilities at Lod, and the facilities at The Technion are limited, all model testing will be conducted in England at the British Aircraft Corporation.

M. Arens, formerly with Curtiss-Wright and educated at MIT and CalTech, is Vice-President in charge of engineering. Before coming to Lod, Arens was on the staff of the Aeronautical Engineering Department at The Technion.

Dr. A. Libai is head of the Structures Department. Formerly a student of Eringen at Purdue, Libai has continued his interest in the theory of thin shells to the extent that he teaches an evening course in Tel Aviv on the subject, which offers credit toward an advanced degree at The Technion. (In this way, the problem of the physical separation of Tel Aviv as the center of industry and hence of engineers and The Technion can be resolved without building a new engineering school.) He has recently extended the earlier work "On the nonlinear elastokinetics of shells and beams," (Journal of Aerospace Sciences, Oct. 1962) in a soon-to-be-published paper which develops an invariant stress function for a shell of general shape that leads directly to the membrane contribution.

One of Libai's graduate students is studying the stability of a cylindrical shell acted upon by both a tangential and a dead surface load. The tangential load is assumed to remain tangent to the shell surface after deformation, while the dead load maintains its original direction.

Another graduate student is studying the vibration of a pressurized ellipsoidal shell of revolution. The deflections due to pressure are taken to be finite, while the vibration is considered to be a small perturbation on the initial state. In this way, the criterion of stability may be studied.

Dr. A. Adini, a former student of Clough at Berkeley, is Head of the Computing Department. Working with a Philco computer, the Department has accumulated a library of stiffness element matrices, including plane stress and axial force elements.

(H.E. Williams)

SOMETHING NEW AT THE UNIV. OF WARWICK

This is the second year for the Univ. of Warwick -- they have yet to graduate a class. Situated in the "Green Belt" three miles south of the center of Coventry, the campus shares the advantages of the industrial north and the rural life of Warwickshire. The address on Gibbet Hill Road and the reconstructed farmhouse which is used by the Grounds Department will certainly be a lasting reminder of country life.

One could elaborate at length about the many new features of educational life at Warwick -- the Mathematics Dept. of Prof. E.C. Zeeman that is all pure mathematics, the Molecular Sciences Dep. which encompasses chemistry and biology, and other facets -- but it is the purpose here to say something about engineering.

Head of the Department of Engineering Science is Prof. J.A.Shercliff. His book, A Textbook of Magnetohydrodynamics (Pergamon Press, 1965), and his research (see Shercliff and M.D. Cowley, "The dynamics of electrically conducting gases in magnetic fields," Symposium on Dissociating and Ionizing Gases in Engineering, Cambridge, 1964) at Cambridge prior to his coming to Warwick are both well known. He started research at Warwick immediately upon arrival there and is currently studying the flow of liquid mercury in pipes in the neighborhood of discontinuities between conducting and nonconducting walls.

Shercliff recently completed a film on MHD for the series on fluid motion, being sponsored by the US National Science Foundation. The film is a sequel to "Vorticity," as it associates the effect of a magnetic field on the flow of an incompressible fluid with the vorticity. It should soon be available for general distribution.

The department which Shercliff has organized has several novel features. First, Warwick offers a unified three-year engineering science course, designed to suit all kinds of engineers. No selection between different branches of engineering is required before admission; indeed, the course structure allows students to come undecided between engineering, physics or mathematics, and to decide after the first year. One should hasten to add that there is a special electrical science course within the department, into which students may enter after the first term of their second year. This exception is made "...because modern electrical and electronic engineering demands special treatment. The sophistication and breadth of the subject is now so great that students must be allowed to specialize rather more intensely if they are to compete effectively upon graduation..."

One of the more interesting faculty arrangements is the concept of the associate professor. Basically, the title of Associate Professor is conferred by the University on a distinguished professional person either in industry or a research establishment in order to promote graduate work in a particular field. Currently, a MSc course is being offered in the field of automatic control; the first associate professors to be appointed will be connected with this program. The are Mr. R.H.Macmillan (Director of the Motor Industries Research Association, whose station is at Lindley, only a few miles from the University) and Mr. J.G.Thomason (Head of Process Analysis at the Central Instrument Laboratories of International Chemical Industries, Ltd., Reading). The length of time that these men will spend at the University will depend both on the location and nature of their work. Macmillan will probably come often for short periods, while Thomason will come less frequently but probably for longer periods. It is obvious that such appointments constitute an important link with industry. The next graduate program to be established will be a MSc course in fatigue and vibration. Negotiations are now under way for an associate professor in this

area. It should be noted that these appointments are made for an indefinite length of time and are intended to augment the versatility of the permanent staff.

Another interesting feature of the curriculum is the design course given jointly by David L. Turner and John Wright. Turner came to Warwick this year from the Brush Electrical Engineering Co., where he was a consultant in the field of urban transportation (see "Never-Stop Transport and Other Neglected Ideas," New Scientist, 13 Jan 1966). He was previously in the Research Dept. of British Railways. Wright is a structural engineer and also came to Warwick this year.

After the separation of the electrical engineering students in the second year, all remaining engineers take the two-term design course. This is divided roughly into three equal parts. Turner lectures during his third on mechanics, components and the like, while Wright lectures for one third on structures, materials, and fatigue. During the last third, the students will be paired off to undertake an identical project. Roughly two weeks each are to be devoted to preparing drawings, construction, and testing. Both Wright and Turner will supervise, and the staff of the machine shop will be asked to cooperate.

The project for this year is the design of a motor operating on the peristaltic effect. A possible solution may take the form of a pair of wheels running on a flexible hose through which a fluid is pumped (see Fig. 1). It should be noted that these are simply plans for the future, as the first class is just about to begin the course.

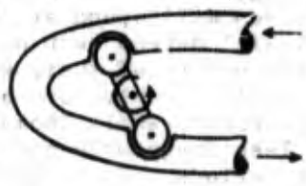


Fig. 1. Motor Operating on the Paristaltic Effect

As a final note, Wright is attempting to set up a design center at the University which would provide expertise to industry in the application of computers to the design of structural steel work. He envisions that such a center would consist of faculty, students, and full-time engineers. Not only would there be the capability to undertake fundamental research problems, but the latest in design techniques would also be available. By employing students, the center would have an economic advantage and the students could derive an educational as well as a financial benefit. Though Wright has met no opposition to his plan locally, there have been objections from universities outside Coventry and also from some consulting engineering firms. (H.E. Williams)

A NEW PROBLEM AREA FOR ENGINEERS

Moving along smoothly at 30 knots, a research vessel of a well-known shipbuilder in the UK suddenly and inexplicably rolled to port (say), and then veered to starboard. Fortunately, the only casualty was a broken rib, but it could have been a general disaster. This event and others less dramatic emphasized to R.E.D. Bishop, Professor of Mechanical Engineering, University College, London, that something must be done in order to predict the dynamic stability of ships.

With a notable background in the theory of vibration, chiefly applied to aircraft and heavy rotating machinery, Bishop notes with some surprise that very little is known about ship stability. More importantly, little or nothing is being done in the UK about implementing existing knowledge. It is clear that Bishop has both a personal interest in this problem and an interest in developing an expertise that would be significant to the national scene. The value of shipbuilding to the economy of the UK is obvious.

As the first step, which will attempt to define the problem areas and to promote interest in the problem, Bishop intends to give a short course on Ship Stability and Control from 26 September to 6 October 1967. In order that students may inspect actual test facilities and become acquainted with current research in this field, half of the course will

be given at the National Physical Laboratory, Feltham, and the other half at the Admiralty Experiment Works (AEW), Haslar, Portsmouth. Hopefully, about 24 students will attend, representing both industry and government laboratories.

Most lectures will be given by Bishop, with the assistance of A.G. Parkinson and Dr. B.S. Massey, who are also members of the Mechanical Engineering Department. Notes which will attempt to order relevant subject areas of mechanics are being prepared for distribution. It is expected that these notes will ultimately form the nucleus for a book on the subject.

If sufficient interest develops in the course, Bishop hopes to establish a permanent graduate course in ship stability at University College. In order to make this course as effective as possible, the continued cooperation of the AEW will be encouraged so that half the program would be given in London and half at Haslar.

If one may judge from Bishop's enthusiasm alone, this undertaking is sure to be an overwhelming success.

(H.E. Williams)

MISCELLANEOUS

SNOW AND ICE RESEARCH IN SWITZERLAND

The winter resort town of Davos is situated high in the jagged, snow-capped Alps in the eastern part of Switzerland not far from the border of Liechtenstein (which, together with Monaco, are reported to be the only European principalities to stand in awe of the armed might of Luxembourg). To reach this scenic town entails a four-hour train trip from Zurich, up over tracks which cling with goat-like tenacity to the steep rocky slopes and then plunge between 5- to 10-ft snow drifts on the relatively level areas in mountain valleys. Transferring to a modern tracked cable car at Davos-Dorf, the traveller is lifted in two steep stages another 1100 m above the valley floor to the Weissfluhjoch terminal. Here in a modern building at 2663 m above sea level is located the Swiss Federal Snow and Avalanche Research Institute.

This establishment traces its history back to 1935 when roots of the present program were established by Professor Naefeli. In 1942 the basic laboratory was constructed on its current site; later additions have since been added in upward step-like progression at periodic intervals. Interestingly, the Institute is administered by the Swiss Federal Department of Forestry and operates within an annual budget of approximately one million Swiss francs (about $240,000). Personnel now comprise eight scientists and 24 supporting staff under the leadership of Dr. M. de Quervain. Organizationally, the establishment is divided into five specialized sections.

Dr. Theodor Zingg, the Vice-Director, heads the first section which is primarily concerned with problems of avalanche prediction. Studies are centered around the meteorological and climatological aspects of snow, as well as the evaluation of snow cover during winter. States Zingg, "The current weather acts especially on the surface layer of a snow cover. The poor heat conductivity of snow is responsible for the thermal instability in a snow cover. This instability produces moisture transport in the upper levels and at the same time a metamorphism of the snow crystals into new shaped grains. This changes also the mechanical and physical properties of the snow cover. The phenomenon depends very much on the depth of the new fallen snow and of the whole snow cover. Especially the temperature gradient and the effective temperature of the snow determine the structure of snow and the grain shape. The avalanche activity depends on the stratigraphy and current weather. Important are: amount and kind of snowfall, wind action (separately or in connection with snowfall), temperature, radiation and rain (especially early in winter and in spring)." To obtain these data, observations are regularly submitted from approximately 50 stations distributed throughout the Swiss and Austrian Alps. These are correlated with local readings from a model field located about 2 km below Weissfluhjoch. Avalanche forecast bulletins are promulgated at least weekly for the benefit of highway departments and winter sports enthusiasts.

Section Two, under Dr. André Roch, studies the mechanical and rheological properties of natural snow, settling and creeping effects, plus avalanche flow and impact phenomena. A practical application of these studies has been the construction of various

types of experimental barriers with the objective of preventing, deflecting or otherwise controlling an avalanche.

Dr. H.R. In der Gand leads the third section which is mainly concerned with reforestation in avalanche zones and the interaction between snow cover and plants, with emphasis on the influence of creeping snow.

Dr. C. Jaccard, head of Section Four, is in process of phasing out of the Davos operation. (He is currently dividing his time between Davos and Neuchatel. He is expected to depart permanently about April 1967 for a full-time professorial position at the University of Nürnberg.) His Section is concerned with the physics of snow and ice, and studies are devoted to the electrical properties and surface effects of crystals. To assist in determination of structural parameters, a photocell microscope (Tomograf) which automatically records its read-out on tape for later computer analysis has recently been designed. Personnel stress, however, that it is yet too early to evaluate the usefulness of this instrument.

Section Five is devoted to the study of atmospheric physics with particular emphasis on the formation and growth of hailstones together with their high-frequency electric properties. Two large hail-tunnels, the most recent installed about two years ago, permit advanced studies under controlled conditions. Dr. Auf der Mauer heads this group.

Swiss studies are not isolated and share a commonality of interest with other groups both in Europe and the US. Some of these are:

a. University of Birmingham. Under the leadership of Dr. J.W. Glen, present projects are concerned with the plastic deformation of ice single crystals at low temperatures with a view to discovering the relationship of drop in plasticity to temperature decrease and in determining information on slip processes from low temperature tests.

b. Finland Institute of Marine Research at Helsinki. Primary mission of the ice department is to provide an information service for winter navigation; however, limited studies on the phenomena of ice cracking during reintensified cold weather and vibration of ice fields in strong wind conditions were completed during the winter of 1965-66.

c. The Laboratory of Concrete Technology, State Institute for Technical Research, Helsinki. Dr. S.E. Pihlajavaara has a continuing program underway to study the compressive strength of ice. Mr. Veli Rahikainen, Lic.Sc., is conducting research to determine the practical feasibility of building ice bridges over the sea.

d. The U.S. Naval Civil Engineering Laboratory at Port Hueneme, California. A number of programs are oriented toward the investigation of the engineering properties of ice and snow. These are centered around the strength of sea ice and field studies in the Antarctic on the baring capacity of processed snow.

e. The Navy Electronics Laboratory, San Diego. Scientists have been engaged in the analysis of data collected during eight nuclear submarine expeditions conducted between 1957-1962 in the Arctic Ocean. Emphasis has been on the preparation of detailed bathymetric and under-ice profiles along all tracks.

To return to the subject of Weissfluhjoch activities: Ski enthusiasts should be interested to learn that they have a choice of three excellent runs averaging 5 km each down to Davos and that all the staff regularly employ this mode of commuting home during the season. (One does not find a cloak room off the foyer of the establishment, only ski racks.) I asked Bruno Salm, assistant in the research activities of Section Two, how long this journey down the mountain took. "Oh," he stated contemplatively, "it takes me about 15 to 30 minutes dependent on the light and weather. My best time was 8 minutes, but since I broke my leg, I don't go so fast anymore!"

(J. Wm. Davis)

OCEAN SCIENCE & TECHNOLOGY

UK DIRECTORY OF MARINE SCIENCES

Within the next few months the Royal Society will publish a directory, Marine Science in the UK. It is being compiled on behalf of the Royal Society's British National Committee for Oceanic Research in cooperation with the Natural Environment Research Council, and follows the general pattern established by the 1964 French publication, La recherche oceanographique francaise - repertoire de

laboratories. The 700-800 scientists listed in the UK Directory, who are involved in some phase of research in the marine sciences, represent a considerable increase over the 275 referred to in An International Directory of Oceanographers published in 1964 by the US National Academy of Sciences and National Research Council.

Appropriately enough, the introduction to the volume is provided by Dr. G.E.R. Deacon, Director of the National Institute of Oceanography. This is followed by an organizational diagram of oceanography in the UK and a brief resume of British and international oceanographic programs, including the International Indian Ocean Expedition, SCOR working groups, and other comparable activities. Next is a map, giving the location of the principal centers of oceanography in the UK, and two tables which list in summary form the major and minor interests of government-funded and university laboratories. The various groups have been arranged in four general catagories: (1) government-funded laboratories which are wholly marine in nature, of which there are 12; (2) university departments with continued interest in marine sciences as part of departmental policy, for which 57 are listed; (3) university departments in which some staff are involved in studies on any aspect of marine science, which includes 20 in the physical sciences and 21 in the biological sciences; and (4) government-funded institutions which are partially concerned with marine science, for which 13 are listed.

The information given for each of the laboratories should be extremely useful to American scientists. In addition to the name, address, and phone number of the present director, the major research interest, major geographic areas of research, and the scientific staff and their specific interests are included. This is followed by a list of research vessels for that particular laboratory, approved future plans, and facilities for training and research by university or other visiting personnel. A selected bibliography is included for each laboratory.

The Appendix also contains some very useful items. There is a general list of British research ships and facilities, a list of libraries offering facilities to workers outside the institution or department, and an index of government-funded laboratories, university laboratories, and marine scientists in the UK. (J.D.Costlow,Jr.)

PHYSICAL SCIENCES

PULSE COMPRESSION IN THE UK

Mr. E.H.("Ted") Boyenval heads the UK governmental activities on pulse compression technology (see E.H.Boyenval, "Pulse Compression Research in the United Kingdom," Radar Techniques for Detection, Tracking, and Navigation, p.35 (Proc. of the 8th Symposium of the AGARD Avionics Panel, London, 21-25 Sep 1964). According to him, recent experience with the Marconi-developed adjustable compensating network (see p. 45 of reference above) indicates that pulse sidelobes can be held down to 40 dB over a wide range of operating temperatures. As small and robust devices for pulse compression, dispersive gratings on crystal quartz (W.S. Mortley, The Marconi Review, 4th quarter, 1965) are useful for bandwidths of 15-20 MHz. Boyenval says that 100 MHz has been obtained with a quartz device and that Marconi, Ltd., (W.S. Mortley, "The Pulse Compression System for Radar," Industrial Electronics, 466, Oct. 1965) will ultimately obtain that bandwidth for systems with pulse lengths of ½ to 5 μ sec.

Of possible interest is a publication, Proceedings of the Conference on Delay Devices for Pulse-Compression Radar (Institution of Electrical Engineers, London, 21 Feb 1966), which is available for approximately $6 from the Secretary, Institution of Electrical Engineers, Savoy Place, London, W.C. 2. Mr. I.L.Davies, Royal Radar Establishment, closed this particular conference by saying that it had been spurred by the needs in radar for high equivalent peak-power and for more flexibility, and for the ability to choose between operating modes so that one can obtain either optimum velocity information or optimum range resolution. Sensible systems have been developed which provide equivalent system bandwidths as great at 20 MHz; but even for these relatively narrow bandwidths, the techniques require large systems that are difficult to set up and too complex for operational use. Acoustic techniques appear to provide promise of ultimately furnishing system band-

widths approaching 100 MHz, but they involve problems of inefficient coupling which have plagued ferrite devices. Although waveguides can be used as dispersive elements, the use of hundreds of meters of waveguide does not constitute a practical technique for many radar applications. There remains a strong need for engineering ideas which will permit the attainment of gigacycle bandwidths. (M.W. Long)

NAVIGATIONAL RADAR STUDIES AT ASWE

Dr. J. Croney, Head of the Antenna Division of the Admiralty Surface Weapons Establishment (ASWE), Portsdown, England, has been interested in the detection of targets in sea clutter since the beginning of radar during the late 1930's. Some of his early papers on clutter are: "A simple logarithmic receiver," Proc. Inst. Radio Engineers 39, 807, July 1951; "The reduction of sea and rain clutter," J. Inst. Navigation 7, 175, 190, April 1954; "Clutter on radar displays; Reduction by use of logarithmic receivers," Wireless Engr. 33, 83, April 1956.

During the last two or three years Croney has again devoted time to clutter studies, and in 1966 he was awarded the PhD degree at Imperial College, London, for his investigations on the correlation of sea clutter pulses and integration time as pertains to a rapid scan radar. This research, and associated investigations on logarithmic amplifiers and a rapid, mechanically scanned antenna have been published. (J. Croney, "Improved radar visibility of small targets in sea clutter," The Radio & Electronic Engr. 32, No. 3, 135, Sept. 1966; A. Woroncow and J. Croney, "A true IF logarithmic amplifier using twin-gain stages," The Radio & Electronic Engr. 32, No. 3, 149, Sept. 1966; W.D. Delany and R.K. Kyle, "Antenna for rapid scan decorrelation radar," ibid, 156, Sept. 1966.) (A good review paper by A. Harrison, "Method of distinguishing sea targets from clutter on a civil marine radar," also appeared in The Radio and Electronic Engineer, 27, 261, April 1964.)

Croney's investigations have been directed toward improving the detectability of navigational buoys in heavy seas. The radar operates at X-band, uses vertical polarization, and antenna speeds are adjustable with a maximum of 1400 rpm. The display system follows the antenna rotation, and prf is such that only one or two pulses per beamwidth are displayed; pulses received from successive looks at the sea clutter are decorrelated. A conventional fluoride PPI tube and a storage PPI tube were used simultaneously. Croney reports that the high scan-rate system, using a PPI and a human observer, gives signal-to-clutter visibility improvements of about 3 dB for 7 to 8-ft waves, and about 6 dB for 3 to 4-ft waves.

Croney uses logarithmic amplifiers to minimize range dependence of displayed sea clutter. Good logarithmic response is obtained for a dynamic range of nearly 100 dB. The amplifier design does not use the successive detection principle with its associated video delay line; it features saturation without bottoming, rapid recovery, bandwidth that is independent of signal level, and does not require neutralization.

The papers immediately above include results for transmitting and receiving vertical polarization. Croney has now obtained comparative results for horizontal and vertical polarizations with an antenna that scans at 600 rpm and for which polarization is alternately changed between horizontal and vertical. His observations indicate that the echo for transmitting and receiving vertical polarization is more effectively decorrelated than it is for transmitting and receiving horizontal polarization; also that echo for horizontal polarization is more bunched or clustered on the PPI. These results are consistent with polarization and statistical data given elsewhere (J.G.Boring, et al, "Sea return study," Georgia Inst. of Technology, Final Report on Contract NObsr-49063, Aug. 1957, DDC No. AD 246 180). (M.W. Long)

NEWS & NOTES

ESRO (the European Space Research Organization) has awarded an 18-million ($22.4-million) contract to a European consortium for the manufacture of two European satellites. The consortium, known as MESH, includes the French Engins Matra, the West German group of Erno, Saab of Sweden and Hawker Siddeley Dynamics of the UK.

Great Britain is to have a national Non-destructive Testing Centre and a

Ceramics Research Centre, to be located at Harwell, home of the Atomic Energy Research Establishment. The Ceramics Research Centre will take over from the Atomic Energy Authority and will serve the iron and steel, electronics, refractories, pottery, glass, and porcelain industries. The Non-destructive Testing Centre will spend about £200,000 a year when fully operational, but is expected to receive an income from payments for sponsored work, royalties, and commercial arrangements.

Manchester Univ. has been awarded a grant of £45,000 by the Science Research Council towards a design study for a new large steerable radio telescope. If the design follows the recommendations of the Science Research Council's 1965 report on Radio Astronomy (the "Fleck Report"), the new instrument may be one of high resolution, at least 400 ft in diameter, costing around £4 million. It will not necessarily be located at Jodrell Bank, but will be a logical extension of the three telescopes already in operation there.

S.P.S. Andrew is the first industrial-based professor to be appointed at Leeds Univ. He is Manager of the Agricultural Division's Catalytic Process Research Group at Imperial Chemical Industries, and has been appointed External Professor to the Dept. of Chemical Engineering at the University. He will guide the Dept's future research program and lecture both undergraduates and advanced groups.

Dr. Arthur F. Brown, Reader in Natural Philosophy at Edinburgh Univ., has been appointed second Professor of Physics at the City Univ., London, from 1 April 1967.

Dr. P.N. Butcher, Head of the Theoretical Physics Section at the Royal Radar Establishment, Malvern, has been appointed to a newly established Professorship of Theoretical Physics at the Univ. of Warwick.

Prof. D.W.J. Cruickshank, who occupies the Joseph Black Chair of Chemistry in Glasgow Univ., has been appointed to a newly created chair in the Dept. of Chemistry at Manchester Institute of Science and Technology.

Dr. A.S.G. Curtis, Lecturer in Zoology at University College, London has been appointed to the new Chair of Cell Biology at Glasgow Univ.

A.J. Dale has been appointed Director of the Organisation and Methods Unit to be established by a consortium of Yorkshire and northeastern universities (Bradford, Durham, Hull, Leeds, Newcastle, Sheffield, and York).

Prof. B.H. Flowers, FRS, is to succeed Sir Harry Melville as Chairman of the Science Research Council in October. Flowers is presently Langworthy Professor of Physics at Manchester Univ., and Chairman of the Computer Board for Universities and Research Councils.

Dr. Samuel S. Gill, acting Head of the Manchester Institute of Science and Technology Dept. of Structural Engineering, has been appointed to the vacant Chair of Structural Engineering at the Institute.

Dr. Alick Isaacs, FRS, died in London on 26 January, aged 45. He was a leading virologist and the discoverer of Interferon. After graduating from Glasgow Univ., and winning a research scholarship to study in the Dept. of Bacteriology, he spent a year at Sheffield Univ. under Prof. C.H.Stuart-Harris, and then two years at the Walter and Eliza Hall Institute in Melbourne, Australia. On his return to England he went to the National Institute for Medical Research Virology Division. He succeeded Sir Christopher Andrewes as Head of the Division in 1961, and later became Head of the Laboratory for Research on Interferon. He was elected a Fellow of the Royal Society in 1966.

Vice-Admiral H.C. Lyddon is to be President, Royal Naval College, Greenwich, in May 1967, in succession to Rear-Admiral R.U. Bayly.

Prof. R.R. Porter, FRS, Pfizer Professor of Immunology, St. Mary's Hospital Medical School, London Univ., has been appointed to the Whitley Professorship of Biochemistry at Oxford Univ., from 1 Oct 1967.

Dr. F. Kingsley Sanders, Director of the Medical Research Council's Virus Research Laboratories at Carshalton, is leaving Britain in September to join Sloane-Kettering Research Institute, New York.

Technical Reports of ONRL

The following reports have recently been issued by ONRL. Copies may be obtained gratis by Defense Dept. and other US Government personnel, ONR contractors, and other American scientists who have a legitimate interest. However, because of the frequent content of proprietary and prepublication information, the reports cannot be sent to libraries or to citizens of foreign countries. Requests for ONRL reports should be addressed to: Commanding Officer, Office of Naval Research Branch Office, Box 39, Fleet Post Office, New York 09510.

ONRL-1-67 Polarization Characteristics of Radar Echoes by M.W.Long

ONRL-2-67 Flight Guidance in West Germany by Dr. Walter M. Hollister (ETH, Zurich)

ONRL-3-67 Engineering Mechanics at the Technion - Israel Institute of Technology, by H.E. Williams

ONRL-4-67 Mechanics and Engineering in Ireland, by H.E. Williams

ONRL-5-67 Materials Research in Israel, by J.B. Cohen

ONRL-6-67 Electronics Research at FOA, by M.W. Long

ONRL-7-67 Marine Sciences in Roumania, by J.D. Costlow, Jr.

ONRL-8-67 Marine Biological Station, University of Liverpool, Port Erin, Isle of Man, by J.D. Costlow, Jr.

ONRL-9-67 Solid State Physics at Some Technical Universities in Northern Germany, by B.O. Seraphin

ONRL-10-67 Structural Mechanics Research at Some Laboratories in France and Switzerland, by G. Herrmann

ONRL-11-67 Operations Research in the Italian Navy, by P.D.Maycock & J.W.Hemann

SUBJECT INDEX FOR VOLUME 20, ESN ISSUES 1 THROUGH 12, 1966

Articles are listed chronologically under subject heading with title, author, and issue page number. Thus, 10:155 indicates issue 10, page 155 of Volume 20.

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R&D
(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) OFFICE OF NAVAL RESEARCH BRANCH OFFICE LONDON, ENGLAND	2a. REPORT SECURITY CLASSIFICATION 2b. GROUP

3. REPORT TITLE

EUROPEAN SCIENTIFIC NOTES 21-2

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

N.A.

5. AUTHOR(S) (Last name, first name, initial)

Rasmussen, J.E. and Hewitson, Victoria, Ed.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
28 February 1967	25	

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
N.A. b. PROJECT NO. N.A. c. d.	ESN-21-2 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) N.A.

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls & each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
N.A.	N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publication.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473

UNCLASSIFIED
Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Material Sciences Mathematical Sciences Mechanics Ocean Sciences & Technology Physical Sciences						

INSTRUCTIONS

1. **ORIGINATING ACTIVITY:** Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. **REPORT SECURITY CLASSIFICATION:** Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. **GROUP:** Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. **REPORT TITLE:** Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. **DESCRIPTIVE NOTES:** If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. **AUTHOR(S):** Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. **REPORT DATE:** Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. **TOTAL NUMBER OF PAGES:** The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. **NUMBER OF REFERENCES:** Enter the total number of references cited in the report.

8a. **CONTRACT OR GRANT NUMBER:** If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. **PROJECT NUMBER:** Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. **ORIGINATOR'S REPORT NUMBER(S):** Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. **OTHER REPORT NUMBER(S):** If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. **AVAILABILITY/LIMITATION NOTICES:** Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. **SUPPLEMENTARY NOTES:** Use for additional explanatory notes.

12. **SPONSORING MILITARY ACTIVITY:** Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. **ABSTRACT:** Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. **KEY WORDS:** Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.

AD NUMBER: AD0809791

LIMITATION CHANGES

TO:

Approved for public release; distribution is unlimited.

FROM:

Distribution authorized to U.S. Government agencies and their contractors; Export Controlled; 10 Mar 1967. Other requests shall be referred to Office of Naval Research, Arlington, VA 22203.

AUTHORITY

ONR ltr dtd 8 Jun 1971

OFFICE OF NAVAL RESEARCH
LONDON

EUROPEAN SCIENTIFIC NOTES

ESN Supplement

10 March 1967

Distributed by the
Office of Naval Research Branch Office,
London

EUROPEAN SCIENTIFIC NOTES
OFFICE OF NAVAL RESEARCH
LONDON

Edited by J.E. Rasmussen and Victoria S. Hewitson

10 March 1967 Supplement

European Scientific Notes is Group II Newsletter type Class B periodical prepared and distributed by the Office of Naval Research London in accordance with NAVEXOS P-35.

Prepared by the Scientific and Technical Staff.
Submitted by A.W. Pryce.

(b) (6)

J. E. CARTER
Commander, USN
Acting Commanding Officer

SUMMARY OF EUROPEAN SCIENCE - 1967

Over the past several months, the Editors of ESN have been considering ways in which the vast fund of background knowledge on European science and scientists which exists in ONRL could best be utilized to assist our US colleagues in planning visits. While most traveling US scientists are familiar with the groups they will visit, in a surprising number of cases this is not true.

In this supplementary issue of ESN, an attempt is made to supply tips and information which will assist in making visits more meaningful. It should be emphasized that this material is intended to be a supplement rather than a substitute for information normally obtained from travel agents and sponsoring government agencies. The miscellaneous comments cover points which, in the experience of this office, frequently create problems or obstacles for the visiting scientist. In addition, information is given on holidays in the more frequently visited countries, international and national professional meetings which have been announced as of 1 February 1967, a bibliography of ONRL technical reports, and a list of ESN articles over the past year covering European laboratories.

The ONRL technical reports provide an unusually complete coverage of a wide range of scientific disciplines here in Europe, organization and programs of laboratories, and work of individual scientists. These reports may be of value in giving a background and/or historical perspective on the work of a given group before a visit is made. While the ESN articles tend to be more general, they also should be of value in this regard. The reports are listed by year of publication and discipline; copies may be obtained from the Defense Documentation Center, Cameron Station, Alexandria, Virginia, 22314.

As a rule, additional international meetings are announced in the "News and Notes" section of ESN as the year progresses. The list contained here will be supplemented in one of the later issues of ESN. In the event this special issue of ESN proves to be of value to the US scientific community, it will be updated and published annually. (The Editors)

MISCELLANEOUS NOTES

VISITS TO FOREIGN GOVERNMENT AND MILITARY SPONSORED LABORATORIES

One of the most common problems encountered by US scientists visiting Europe, including ONR contractors, is that of official clearance to visit military and/or government-sponsored laboratories. Requirements for visit notification and security clearance vary from one country to another, according to the professional affiliation of the visitor and the status of the laboratory being visited. These comments are intended only to alert visitors to the security requirements and serve as a crude guide. When trips are being made under the sponsorship of a government agency, and foreign government or military laboratories will be visited, it is recommended that the requirements for security clearance and/or foreign visit approval be clearly ascertained from the sponsoring agency.

In the case of visitors to university and private laboratories, no formal government clearance is necessary (unless classified research projects will be discussed). Visitors, including University contractors, whose trip is sponsored by the US Department of Defense always require formal clearance for visits to foreign military laboratories. The US agency sponsoring the visit is responsible for initiating the clearance.. Unfortunately, experience has shown that this requirement is overlooked with sufficient frequency as to warrant specific mention here. Thus, it is suggested that this issue be specifically raised with the sponsoring organization in planning visits. Visit notices should be initiated approximately six weeks in advance, so as to permit at least 30 days' advance notice to the Defense Attache of the US Embassy in the country concerned. In France 35 days advance notice, from the time the visit clearance request arrives in Paris, is required. The Italian government requires 45 days' advance notice.

At the risk of being redundant, it should be emphasized that security clearance must be obtained, even if the visit is of an unclassified nature. Failure to adhere to the clearance requirements, including the specific lead time requirement, has on occasion resulted in a visitor being refused admittance to a laboratory even though he has already arrived in Europe. While ONR London is charged with the responsibility for obtaining clearances in the case of Navy-sponsored visits to laboratories in the UK, this office does not possess the required authority to obtain clearances for visits in other countries. Of necessity, clearances for such visits must be cleared through the Naval Attache of each country concerned.

THE EUROPEAN SCIENTIST AND HIS SUMMER VACATION

As a general rule European scientists live and work somewhat differently from their US colleagues. One of the most striking differences is with regard to summer vacation. In Scandinavia, July is the month of summer vacation. Many organizations actually close their doors for the entire month, others operate with a skeleton force. To a lesser extent the same situation prevails in other European countries, with August being the vacation month in France and Great Britain. Because scientists' vacations on this side of the ocean generally are longer than in the States, it is well to check far in advance of making a trip to ensure that the laboratory will be in full operation when the visitor arrives.

THE VISITING AMERICAN SCIENTIST AS SEEN BY HIS EUROPEAN HOST

The message which follows admittedly is rather delicate. However, with the passing of time it becomes increasingly clear that it should be communicated. Over the past several years personal contact between scientists has become a critically important factor in scientific progress. With the proliferation of international research activity, increasing publication lags, and rapidity of technical developments, visits to foreign universities and laboratories are no longer merely desirable, such interchanges are rapidly becoming mandatory. There are two sides to this coin, however, and it is to the "other" side that these remarks are addressed.

Over the years the staff of this office has at times been amused and at other times amazed as they sit on the sideline and watch the stream of visiting scientists flow back and forth across the Atlantic Ocean. It is difficult for the average American, who has not been exposed to a similar perspective, to realize the number of his colleagues who visit European laboratories each year. Even more interesting are the techniques which the European laboratories have adopted in order to cope with the stream of visitors.

At the risk of over-generalizing (and with tongue only partially in cheek), it might be safe to say that there is a correlation between the specific European laboratories visited by Americans and the tourist attractions of the area in which they are located. For example, laboratories in Stockholm, metropolitan and historic sections of England, Paris, and Rome appear to have far more appeal and "importance" than do equally sophisticated institutes in relatively isolated and uninteresting areas. Without question, the laboratories and work in many of the metropolitan centers is superb and well worth a visit. At the same time, there is a surprising frequency of visits to laboratories where the work holds little relevance to the visitor's own professional interest and expertise.

One laboratory is understood to cope with this problem in a rather interesting fashion. A scale has been devised in this organization to rate the mutual benefit of the proposed visit. Members of the staff consider the visitor's background and his work and determine the nature of the reception he shall receive. The only thing not considered on this scale is the "importance" or professional position of the visitor. The department chairman from a US university or director of a government laboratory or other dignitary whose work obviously is unrelated to the laboratory in question will be given a 15-minute tour by an assistant. In this way the staff of the laboratory have made it possible for the visitor to carry out his itinerary. At the same time, neither the visitor nor the laboratory staff have devoted time to a discussion which is not truly of interest. Scientists whose work is directly related to the laboratory, so that considerable interaction of mutual benefit is anticipated, are

received with open arms. Other laboratory directors, who feel that the work of their organization can continue in spite of the constant flow of visitors, are more gracious though perhaps less considerate of the visitors and their own time. However, one often wonders whether they have the same table reserved for lunch each day at the most charming or "typical" restaurant in town.

Because of the large number of Americans visiting the better known European laboratories, it is highly important to make appointments well in advance and to keep the appointment, once made. Not only do Europeans in general tend to be more formal with regard to laboratory visits than do their American colleagues, but their staffs are usually much smaller than those in the US. Thus, foreign visitors actually can and often do constitute a significant source of disruption to ongoing research efforts.

Because European scientists on the whole have a surprisingly comprehensive knowledge of the US literature in their discipline, the individual whose work they know usually is well received. However, a person unknown to the laboratory may have a rather strained and short visit with a senior scientist and spend most of his time with graduate students or assistants. Quite possibly he will not be received at all -- particularly during the summer months. This is not a lack of courtesy or a reflection on the character of science in the country involved -- it is a measure of self-protection.

HOTEL ACCOMMODATIONS

Hotels in all major cities throughout Europe and the United Kingdom are very crowded during the tourist season from approximately 1 April to 1 October. Particular difficulty may be encountered in Rome and Spain. Reservations should be made as early as possible, bearing in mind that extensions beyond the specific dates requested are not always possible. Most hotels require a minimum of 48-hours notice of cancellation or a visitor is liable for charges. Additionally, most hotels require notification of late arrival, since they do not normally hold reservations after 6 p.m. Hotel reservations will be particularly difficult to obtain in Denmark between 1 March and 1 October of this year, when the country celebrates its eight-hundredth-year anniversary. The AAA manual Motoring Abroad - Travel Guide to Europe is an excellent guide for selecting hotels. Its descriptions and opinions have proved reliable.

TRAVEL

Frequent air service is available between most European capitals and other large cities. Many countries (England not included) have an airport tax which ranges from $0.85 to $3.00, payable in local currency for all flights out of the country. Travelers are wise to ascertain what this tax is upon arrival and insure that they have adequate local currency to pay the tax upon departure. European flights booked in the United States should be reconfirmed as soon as possible after arrival at the first point, and at each subsequent stopover. Once firm reservations are made on a domestic flight in the UK (England, Scotland, and Northern Ireland), they may not be cancelled without payment of a cancellation charge of $2.80. This charge doubles to $5.60 if a booking is cancelled within 48 hours of scheduled departure.

Rail travel in the UK, Western Europe, and between the UK and Western Europe is reasonably priced (approximately $0.06 per mile for first class travel) and its use may be preferable during the winter months when air travel is restricted due to weather conditions. Extra fares are, however, not uncommon on fast trains. Sleepers are available for longer overnight journeys, but should be booked well in advance with the understanding that a charge is made for cancelled sleeper bookings. There are excellent overnight through trains from London to the Continent, Paris and Brussels in particular, which may be preferable to airplanes if one has early morning appointments in these cities. Travel by overnight train with a sleeper is, however, more expensive than air travel. Train travel frequently is faster than by air between Amsterdam-Brussels and Paris-Brussels, in terms of total time elapsed from the center of one city to another.

Hertz and Avis car rental agencies have offices in almost very principal

city in Europe. In most cases cars may be rented in one town and left at another without a drop charge. Credit cards issued in the US are accepted by these agencies in Europe, and all US Government official travelers are entitled to a ten percent discount in Europe, but one must ask for it when renting the car since it is not automatic. Gasoline credit cards however are not accepted. International Driver's Licenses are useful and are required in Spain, Austria, Finland, Greece, Portugal and Turkey.

CURRENCY

There are no restrictions on the amount of US currency or travelers' checks that an American may take in or out of any European country, and exchange facilities are available at most airports and through banks. Many countries have a restriction on the amount of their currency which may be taken out. The American dollar is also accepted by most hotel and business establishments, although one cannot expect the rate to be as good as the official exchange rate. It is suggested you bring $10 - $20 in $1 bills in the event a smaller additional amount of a particular currency is required.

TAXI SERVICE

Taxis are plentiful and reasonably priced in London. It is expected hat you will tip the driver between 10% and 15% of what is on the meter. Taxi from central London going outside the six-mile radius are permitted to charge a return fare. There is no set fare from London Airport to town, therefore, negotiate before starting, or, better yet, take the Airline bus. Taxis in Athens have two rates -- one for the city, which is cheaper, and one for the suburbs. The meter ticks faster on the city rate, so listen for the tick. Taxis in most countries use varying methods in computing fares. If going on a reasonably long ride, it is wise to get an estimated price from the driver in advance.

LANGUAGE

Communication in English is possible with most scientists in Europe. However, difficulty occasionally may be encountered with older men in Southern France, Italy, and Germany. A working knowledge of a foreign language, particularly French, is helpful but not essential.

U.S. SCIENTIFIC ATTACHES IN U.S. MISSIONS ABROAD AND THEIR REGIONAL RESPONSIBILITIES

Embassy	Scientific Attache and Deputy	Regional Responsibilities
EUROPE:		
Belgrade, Yugoslavia	Mr. Wilfred F. Declercq (Jan.)	
Bern, Switzerland	Dr. Henri Bader	International Scientific activities at Geneva
Bonn, Germany	Dr. William W. Williams Dr. Norman P. Neureiter	Netherlands Austria
London, England	Dr. Alan Mencher, Acting	Ireland
Moscow, Russia	Mr. Christopher A. Squire (Science Reporting Officer)	
Paris, France	Dr. Edgar L. Piret Mr. Harding Ballough Mr. John Buehler	Belgium, Spain and Portugal
Rome, Italy	Dr. Walter Ramberg	Greece
Stockholm, Sweden	Dr. Clyde L. McClelland Mr. John A. Collins	Finland, Norway, Denmark Iceland
Warsaw, Poland	Mr. Alton L. Jenkens	
U.S. Mission to OECD, Paris	Dr. Philip W. Hemily	OECD Science Program
LATIN AMERICA:		
Buenos Aires, Argentina	Dr. Nathan H. Woodruff	Paraguay, Uraguay and Chile
Rio de Janeiro, Brazil	Dr. Andre C. Simonpietri Mr. James Asper	Colombia, Venezuela, Peru, Bolivia and Ecuador
FAR EAST:		
Canberra, Australia	Dr. Paul A. Siple	New Zealand
Tokyo, Japan	Dr. Robert T. Webber Mr. Howard McElroy	Korea, Philippines, Taiwan and Hong Kong
NEAR EAST AND SOUTH ASIA:		
Cairo, Egypt	Mr. Slator Blackiston, Jr. (Acting)	Lebanon, Syrian Arab Republic and Iraq
New Delhi, India	Dr. Donald L. Fuller	Ceylon
Tehran, Iran	Dr. Herman I. Chinn	Pakistan and Turkey
Tel Aviv, Israel	Mr. Michael G. Kelakos	

BANK HOLIDAYS OF COUNTRIES FREQUENTLY VISITED

January to December 1967

AUSTRIA - Jan. 6; March 25, 27; May 1, 4, 13, 15; August 15; October 26; November 1; December 8, 25, 26.

BELGIUM - March 25, 27; May 1, 4, 13, 15; July 21; August 15; November 1, 11; December 25.

CEYLON - Jan. 1, 3, 10, 13, 18, 25; Feb. 2, 4, 9, 17, 24; Mar. 3, 9, 10, 17, 24, 25, 26; April 2, 9, 13, 14, 17, 24; May 1, 8, 16, 23, 24; June 7, 15, 21, 22, 29, 30; July 6, 14, 21, 29; Aug. 5, 13, 20; Sept. 3, 11, 26; Oct. 3, 11, 18, 25; Nov. 1, 9, 16, 24; Dec. 1, 9, 16, 23, 25, 30, 31.

CONGO, REPUBLIC OF - (Kinshasha) Jan. 1, 4; May 1; June 30; Aug. 15; Oct. 15; Nov. 1, 11, 17; Dec. 25; (Burundi) Jan. 1; May 1; July 1; Aug. 15; Sept. 18; Oct. 13; Nov. 1; Dec. 15, 25, 27.

DENMARK - March 23, 24, 27; April 21; May 4, 15; June 5; Dec. 25, 26.

EGYPT (UAR) - Jan. 7, 12, 13; March 21, 22; April 11, 23, 30; May 1; June 18, 20; July 1, 23.

ENGLAND,
WALES,
NORTHERN IRELAND AND
REPUBLIC OF IRELAND - Mar. 17 (Ireland only), 24, 27; May 29; Aug. 28; Dec. 25, 26.

FINLAND - Jan. 6; March 24, 25, 27; May 1, 4, 15; June 23, 24; Nov. 4; Dec. 6, 25, 26.

FRANCE - Jan. 2; March 24, 27; May 1, 3, 4, 15; July 13, 14; Aug. 14, 15; Oct. 31; Nov. 1; Dec. 25.

GERMANY (WEST) - Jan. 1, 6; Mar. 24, 27; May 1, 4, 15, 25; June 17; Aug. 15; Nov. 1; Dec. 25, 26.

GIBRALTAR - Jan. 1; Mar. 24, 27; May 24; June 10; Aug. 28; Dec. 25, 26.

GREECE - Jan. 6; March 13, 25; April 28; May 1, 15, 25; June 19; Aug. 15; Oct. 28; Dec. 25, 26.

INDIA - Bangalore: Jan. 13, 14, 26; Mar. 9, 22, 24; Apr. 10, 21; June 21, 30; Aug. 15; Sept. 7; Oct. 2, 3, 11, 12; Nov. 1, 2; Dec. 25; Calcutta: Jan. 13, 23, 26; Feb. 14; Mar. 24; Apr. 15, 21; June 30; Aug. 15, 28; Oct. 2, 3, 9-13, 17; Nov. 1, 17; Dec. 25; Cochin: Jan. 13, 26; Mar. 22, 24; Apr. 14, 21; May 1; June 21, 30; Sept. 14, 15, 21; Oct. 2, 10-12; Nov. 1; Dec. 25; Madras: Jan. 13, 14, 26; Mar. 22, 24; Apr. 10, 14, 21; May 24; June 30; Aug. 15; Oct. 2, 11, 12; Nov. 1; Dec. 25, 30; Mahavashtra: Jan. 13, 26; Mar. 22, 24; Apr. 10, 14, 21, 22; May 1, 11; June 21; Aug. 1, 15, 30; Sept. 4, 7; Oct. 2, 12; Nov. 3, 27; Dec. 25.

IRAQ - (Approx. dates) Jan. 6, 12, 13, 14; Feb. 8; Mar. 21, 22, 23, 24; Apr. 10, 19; May 1; June 19; July 14; Nov. 18.

ISRAEL - Jan. 1; Mar. 26, 27; Apr. 25; May 1, 15; June 14; Aug. 15; Oct. 5, 6, 14, 19, 26.

ITALY - Jan. 6; Mar. 27; April 25; May 1, 4, 25; June 2, 29; Aug. 15; Nov. 1; Dec. 8, 25, 26.

MONACO (PRINCIPALITY) - Jan. 2, 27; Feb. 7; Mar. 2, 24, 27; May 1, 3, 4, 15, 25; July 13, 14; Aug. 14, 15; Oct. 31; Nov. 1, 20; Dec. 8, 25.

NETHERLANDS - Mar. 24, 27; May 1, 4, 15; Dec. 25, 26.

NORWAY - March 23-25, 27; May 1, 4, 15, 17; Dec. 25, 26.

PAKISTAN - Jan. 6, 12, 13; Mar. 21-23; Apr. 21; June 21; July 1; Aug. 14; Sept. 11; Oct. 27; Dec. 25.

PORTUGAL - Feb. 7; Mar. 23, 24; May 25; June 10, 13, 24; Aug. 15; Oct. 5; Nov. 1; Dec. 1, 8, 25.

SCOTLAND - Jan. 1; Mar. 24; May 29; Aug. 28; Dec. 25.

SPAIN - Jan. 6; Mar. 24; May 1, 4, 25; June 29; July 18, 25; Aug. 15; Oct. 12; Nov. 1; Dec. 8, 25.

SWEDEN - Jan. 6; Mar. 24, 27; May 1, 4, 15; June 24; Dec. 25, 26.

SWITZERLAND - Mar. 24, 27; May 4, 15; Dec. 25, 26; in addition to these, various cities have other holidays.

SCIENTIFIC MEETINGS IN EUROPE 1967

APRIL

2-8	European Society of Radiology 1st Congress Prof. Gros, Hopital Civil Strasbourg, France	Barcelona
3-5	Thin Film Conference - Resistive & Dielectric Properties of Thin Films Meetings Officer, IPPS 47 Belgrave Square London, S.W. 1, England	Nottingham
3-6	Chemical Society Anniversary Meetings General Secretary, Chemical Society Burlington House London, W.1, England	Exeter
4-6	Combustion in Advanced Gas Turbine Systems, Cranfield International Propulsion Symposium Dr. I.E. Smith Dept of Aircraft Propulsion, College of Aeronautics Cranfield, Bedfordshire, England	Cranfield
4-8	19th British Mathematical Colloquium 1967 Dr. A J.Ellis, Dept. of Pure Mathematics University College, Singleton Park Swansea, England	Swansea
5-7	Conference on "Spark Discharges", IPPS Atomic & Molecular Physics Sub-Committee Meetings Officer Institute of Physics & Physical Society 47 Belgrave Square London, S.W. 1, England	Liverpool
10-14	Environmental and Human Factors in Engineering Conference Secretary Institute of Sound & Vibration Research The University Southampton	Southampton
10-15	International Conference on Electronics & Space M. Bignier, Chairman of Organizing Committee Colloque International sur l'Electronique et l'Espace 16 rue de Presles Paris 15e, France	Paris
11-13	The Structure and Properties of Liquids The Assistant Secretary, Faraday Society 6 Gray's Inn Square London, W.C. 1, England	Exeter
11-13	Symposium on Decision Making in National Science Policy The CIBA Foundation 41 Portland Place London, W.1, England	London
12-13	Institute of Physics & Physical Society; Conference on Point defects in Metals IPPS address above	Reading

APRIL

13-14	The Teaching of Mathematics in the Training of Physicists The Meetings Officer, IPPS 47 Belgrave Square London, S.W.1, England	Exeter
13-14	Conference on the X-ray Analysis of Biological Materials IPPS, address above	Oxford
14-21	International Congress and Exhibition on Measurement, Control, Regulation and Automation, including Section on Nuclear Measurements & Reactor Control MESUCORA Association 37 Avenue de Breteuil Paris 7e, France	Paris
17-19	Conference on Elementary Particles IPPS, address above	London
17-19	Meeting on Semiconductors, Metals & Magnetics Dr.-Ing. H.H. Burghoff, German Section IEEE Stresemann Allee 21, VDE-Haus 6 Frankfurt/Main 70, Germany	Bad Nauheim
17-20	Symposium on Advances in Extractive Metallurgy Secretary, Inst. of Mining & Metallurgy 44 Portland Place London, W.1, England	London
17-22	3rd International Conference on Cartography c/o Congress Bureau 4 St.-Agnietenstraat Amsterdam-C, Netherlands	Amsterdam
17-20	Physics Exhibition IPPS, address above	London
18-2 May	9th International Hydrographic Conference Vice-Admiral Alfredo Viglieri President of the Directing Committee International Hydrographic Bureau Avenue President J.F. Kennedy Monte Carlo, Monaco	Monte Carlo
19-22	Conference on Semiconductor Device Research Dr.-Ing. H.H. Burghoff German Section IEEE Stresemann Allee 21, VDE-Haus 6 Frankfurt/Main 70, Germany	Bad Nauheim
23-27	4th International Conference on the Science of Ceramics Dr. J. de Jong, Secretary Nederlandse Keramische Vereniging Stieltjesweg 1 Delft, Netherlands	Maastricht
24-26	Conference on Image Detection & Processing IPPS, address above	RRE, Great Malvern Worcs.

APRIL

24-29	International Committee of Electrochemical Thermodynamics and Kinetics Meeting Dr. M. Fleischmann, Dept. of Physical Chemistry University of Newcastle upon Tyne Newcastle upon Tyne, England	Mittenwald, Germany
26-27	Symposium and Exhibition on Noise Production Engineering Research Assoc. Melton Mowbray, Leics, England	Melton Mowbray

MAY

2-6	Annual Meeting of the Société de Chimie Physique Prof. G. Emschwiller, Secretary-General 10 rue Vauquelin Paris 5e, France	Paris
8-10	Static Electrification The Meetings Officer, IPPS 47 Belgrave Square London, S.W.1, England	London
8-11	International Symposium on Molecular Associations in Biology Prof. B. Pullman c/o Institut de Biologie Physico-Chimique 13 rue Pierre Curie Paris 5e, France	Paris
16-20	International Colloquium on Solid Inorganic Phosphates Secretariat, Departement de Chimie Inorganique Faculte des Sciences, 28 rue des Trente-Six Ponts 31 Toulouse, France	Toulouse
17-22	2nd European Symposium on Fresh Water from the Sea Prof. A.A. Delyannis, Secretariat P.O.B. 1199, Omonoia, Athens, Greece	Athens
22-24	Deutsche Gesellschaft für Raketentechnik ü Raumfahrt Theme: Communications Satellite DGRR, am Glockenbach 12 8 München 5, Germany	Bordeaux
22-27	Symposium on Oxides of Sulphur in Modern Chemistry Congress Secretariat, Institute of Chemical Engineering, Univ. of Toulouse Chemin de la Loge-Empalot Toulouse, France	Toulouse

JUNE

6-9	Symposium on Modern Treatment of Glass Surface Secretariat, Union Scientifique Continentale du Verre, 10 Blvd Defontaine Charleroi, Belgium	Luxembourg
6-10	10th International Gas Conference Mr. R.H. Touwaide, General Secretary International Gas Union, 4 Avenue Palmerston Brussels 4, Belgium	Hamburg

JUNE

7-9	Conference on Industrial Physics - The Contribution of Government Sponsored Laboratories IPPS, The Meetings Officer 47 Belgrave Square London, S.W.1, England	Harrogate
12-17	Symposium on the Chemistry & Internal Structure of Synthetic High Polymers Prof. G. Smets, Laboratory of Macromolecular Chemistry, Univ. of Louvain 99 rue de Namur Louvain, Belgium	Louvain
12-19	2nd International Conf. on Solid Compounds of Transition Elements Mr. J.C. Wildervanck, Lab. of Inorganic Chemistry, State Univ. of Groningen Groningen, Netherlands	Univ. of Twente Enschede
19-23	14th International Scientific Congress on Electronics Secretariat, Rassegna Internazionale elettronica, nucleare e teleradiocinematografica Ufficio Congressi, Via Crescenzio 9 Rome, Italy	Rome
19-23	2nd Journées Internationales d'Etude des Piles a Combustible Secretariat of the Congress, SERAI 1091 Chaussee d'Alsemberg Brussels, 18, Belgium	Brussels
21-29	European Meeting of Chemical Engineering 1967 DECHEMA, Postfach 7746 6 Frankfurt/Main 7, Germany	Frankfurt/Main
26-1 July	5th International Congress of Chemotherapy Sekretäriat, 5 Internationaler Kongres für Chemotherapie, c/o Wiener Medizinische Akademie Alserstr. 4 1090 Vienna, Austria	Vienna
27-2 July	2nd Colloquium on Thin Films Optikai Akusztikai és Filmtechnikai Egyesület Szabadsag ter 17 Budapest 5, Hungary	Budapest

JULY

-	Seminar on the Whole Spectrum of Modern Theoretical Physics International Center for Theoretical Physics Piazza Oberdan 6 Trieste, Italy	Trieste
3-5	Meeting on Electron Diffraction - Electron Microscopy & Analysis Group in association with The International Union of Crystallography IPPS, address above	London
5-7	Accuracy of Spectroscopic Methods IPPS, address above	Birmingham

JULY

7-13	XIV World Dental Congress Federation Dentaire Internationale Secretariat General, 22 Avenue de Villiers Paris 17e, France	Paris
8-15	Annual Assembly of the International Institute of Welding British Organising Committee, Inst. of Welding 54 Princes Gate, Exhibition Road London, S.W.7, England	London
10-12	International Symposium on Naturally Occurring Phosphoric Esters Chemical Society Burlington House, Piccadilly London, W.1, England	Newcastle/Tyne
10-12	Astronomical Optics The Meetings Officer, IPPS 47 Belgrave Square London, S.W.1, England	London
11-13	4th Symposium on Special Ceramics Mr. B. Popper, British Ceramic Research Assoc. Queens Road, Penkhull Stoke-on-Trent, England	Stoke-on-Trent
10-14	Annual Scientific Meeting of the British Medical Association Secretary, BMA Tavistock Square London, W.C.1, England	Bristol
11-14	2nd International Conference on Magnet Technology Technological Information on Magnets associated with Research in Physics - especially High Energy Physics Mr. R.C. Pepperell, Conference Secretary Rutherford High Energy Laboratory Didcot, Berks, England	Oxford
17-21	Symposium on Solar-Terrestrial Relationships during Solar Minimum Conditions Dr. G. de Q. Robin, c/o Scott Polar Research Institute, Cambridge University Cambridge, England	London
17-23	5th International Conf. on the Physics of Electronic and Atomic Collissions Organizing Committee for the Conference A.F. Ioffe Physico-Technical Institute Leningrad K-21, USSR	Leningrad
18-20	Conference on Computer Technology Joint Conference Secretariat Institute of Electrical Engineers, Savoy Place London, W.C.2, England	Manchester
18-23	1st World Conference on Laser Applications & World Exhibition of Instruments & Laser Techniques M. Marcel Locquin, Chairman of Organizing Committee 38 avenue George V Paris 8e, France	Paris

JULY

23-29	10th Plenary Meeting of the Committee on Space Research Monsieur J. Gazin, Executive Secretary, COSPAR 55 Blvd Malesherbes Paris 8e, France	London
25-27	International Symposium on Solution Properties of Natural Polymers Chemical Society Burlington House, Piccadilly London, W.1, England	Edinburgh
28-2 Aug	Operations Research Around the World Meetings Mr. J.E. Walsh System Development Corporation Santa Monica, California	Madrid

AUGUST

7-12	XIV International Spectroscopy Colloquium Deputy General Secretary, Hungarian Society of Mechanical Engineers Szabadság Tér 17 Budapest V, Hungary	Debrecen, Hungary
14-18	14th International Symposium on Microscopy (MICRO-67) McCrone Research Institute 451 East 31st Street Chicago, Illinois 60616	Cambridge, England
24-28	2nd European Symposium on Marine Biology Prof. Hans Brattström, Director Biological Station, Espegrend Blomsterdalen, Norway	Espegrend
27-2 Sep.	8th International Conference on Ionization Phenomena in Gases Dr. F. Viehböck Ostereichische Studiengesellschaft für Atomenergie Lenaugasse 10 1082 Venna VIII, Austria	Vienna
27-3 Sep.	XXIV Conference of International Union of Pure & Applied Chemistry Dr. Rudolf Morf, Secretary General of IUPAC c/o F. Hoffman-La Roche & Co. 4002 Basle, Switzerland	Prague
28-2 Sep.	IUTAM Symposium on the Generalized Cosserat Continuum & the Continuum Theory of Dislocation with Applications Prof. E. Kröner, Bergakademie Clausthal Adolf Römerstrasse 2A Clausthal-Zellerfeld, Germany	Stuttgart & Freudenstadt
30-6 Sep.	British Association for the Advancement of Science Meeting BAAS, 3 Sanctuary Buildings 20 Great Smith Street London, S.W.1, England	Leeds

AUGUST

30-7 Sep.	12th International Congress of Refrigeration International Institute of Refrigeration 177 Blvd Malesherbes Paris 17e, France	Madrid

SEPTEMBER

4-8	Solid State Devices The Meetings Officer, IPPS 47 Belgrave Square London, S.W.1, England	Manchester
5-7	Physics of Quasars IPPS, address above	Manchester
5-9	II IUTAM Symposium on Thin Shells Prof. F. Niordsen, Chairman of Scientific Committee Technical Univ. of Denmark, Rigensgade 13 Copenhagen K, Denmark	Copenhagen
5-9	10th International Congress of Microbiological Standardization Mr. E.C. Hulse, c/o Central Veterninary Laboratory Weybridge, England	Budapest
10-15	9th European Congress on Molecular Spectroscopy Mr. J. Morcillo c/o Instituto de Chimica-Physica, Seranno 119 Madrid 6, Spain	Madrid
11-15	3rd International Congress on Ergonomics P.O. Box No. 363 Birmingham 15, England	Birmingham
11-15	International Symposium on Information Theory Lt.Col. B.R. Agins (SRMA), AFOSR 1400 Wilson Arlington, Va. 22209	Athens, Greece
11-15	Introduction to Static Structural Matrix Analysis Conference Secretary, Inst. of Sound & Vibration Research, Southampton University Southampton, England	Southampton
11-15	5th International Congress on Cybernetics Secretariat, Int'l Assoc. for Cybernetics Palais des Expositions, Place A. Rijckmans Namur, Belgium	Namur
12-13	Symposium on Heat Treatment Production Engineering Research Assoc. Melton Mowbray, Leics, England	Melton Mowbray
13-14	High Voltage Insulation in Vacuum IPPS, address above	London
18-23	Stochastic Problems in Underwater Sound Propagation NATO-MARINA ITALIANA Advanced Study Institute Prof. Maurizio Federici, c/o USEA Via P. Mantegazza nr. 23 San Terenzo (La Spezia), Italy	Lerici, La Spezia

SEPTEMBER

20-22	Stress Analysis in Bio-engineering The Meetings Officer, IPPS 47 Belgrave Square London, S.W.1, England	London
20-22	International Symposium on Surface Phenomena of Metals Prof. K.S.W. Sing Dept. of Chemistry, Brunel College, Woodlands Ave., London, W.3, England	London
20-23	International Conference on the Use of Radioactive Isotopes in Pharmacology Prof. B. Glasson, Pavillon des Isotopes 20 Boulevard d'Yvoy 1211 Geneva 4, Switzerland	Geneva
24-30	Deutsche Gesellschaft für Rakententechnik und Raumfahrt, 18th Int'l Astronautical Congress DGRR, am Glockenbach 12 8 München 5, Germany	Belgrade
25-7 Oct.	14th General Assembly of the International Union of Geodesy & Geophysics Mr. V.C. Bossart, Sec'y Gen'l of the Assembly Neustadtgasse 7 8001 Zurich, Switzerland	Zurich
26-28	International Conference on the Physics Problem in Reactor Shielding Design Mr. P.B.E. Thompson, Assistant Secretary British Nuclear Energy Society 1-7 Great George Street London, S.W.1, England	London
26-28	Magnetic Materials & their Applications IPPS, address above	London
29-6 Oct.	4th Int'l Conference on Atmosphere & Space Electricity, AFCRL, Army, Navy, NSF and NASA M.B. Gilbert (CRTE) Air Force Cambridge Research Laboratories L.G. Hanscom Field Bedford, Mass. 01731	Lucerne Switzerland

OCTOBER

2-7	32nd Physicists Conference Prof. E. Boersch, c/o Physikalisches Institut Technische Universität, Harderbergstr. 34 Berlin 12, Germany	Berlin
11-14	4th Congress on Material Testing Deputy General Secretary Hungarian Society of Mechanical Engineers Szabadság Tér 17 Budapest V, Hungary	Budapest
7-12	15th International Communications Congress Secretariat, Istituto Internazionale delle Comunicazioni, Viale delle Brigate Partigiane 18 Genoa, Italy	Genoa

OCTOBER

9-18	Meeting of International Council for the Exploration of the Sea ICES, Charlottenlund Slot Charlottenlund, Denmark	Hamburg
8-10	Conference on MF, LF, and VLF Radio Propagation Joint Conference Secretariat Institute of Electrical Engineers, Savoy Place London, W.C.2, England	London
14-25	International Glass Days, 5th Congress General Secretary, c/o Musee du Verre 13 quai de Maestricht Liege, Belgium	Damascus

DECEMBER

7	Interplanetary Spaceflight DGRR, am Glockenbach 12 8 München 5, Germany	Munich

BIOLOGICAL SCIENCES

ONRL 2-62	J.W. Foster	- Microbiology at the University of Liverpool
ONRL 3-62	"	- Microbiological Science at the University of Manchester
ONRL 12-62	"	- Two Microbiological Service Laboratories
ONRL 16-62	"	- A Microbiological Excursion to Scotland
ONRL 17-62	"	- General Microbiology at King's College, Durham Univ., Newcastle upon Tyne
ONRL 44-62	"	- Non-medical Microbiological Science in West Germany and Switzerland
ONRL 69-62	"	- Microbiology in The Netherlands
ONRL 72-62	"	- Notes on Microbiological Laboratories in Hamburg, Denmark and Norway
ONRL 74-62	"	- A Microbiologist Looks at Czechoslovakia
ONRL 75-62	"	- Microbiology in Belgium
ONRL 1-62	S.W. Handford	- A Survey of Research in Physiology and Allied Fields at London University: Pt. I - St. Bartholomew's, Guy's and St. Thomas's Hospital Medical Schools
ONRL 4-62	"	- A Survey of Research in Physiology and Closely Related Fields at London University: Pt. II - Middlesex, The Royal Free, London and Charing Cross Hospital Medical Schools
ONRL 8-62	"	- A Survey of Research in Physiology and Closely Related Fields at London Univ: Pt. III - St. Mary's and Post-graduate Hospital Medical Schools and the Institute of Psychiatry
ONRL 11-62	"	- A Survey of Research in Physiology and Allied Fields at London University: Pt. IV - The Institutes of Basic Medical Sciences, Neurology and Ophthalmology
ONRL 19-62	"	- A Survey of Research in Physiology and Closely Allied Fields at London University: Pt. V - The Lister Institute of Preventive Medicine, The London School of Hygiene and Tropical Medicine, The Institute of Cardiology and Bedford College
ONRL 32-62	"	- A Survey of Research in Physiology and Closely Related Fields at London University: Pt. VI - The Royal Veterinary College, King's College, University College Hospital Medical School and University College
ONRL 36-62	"	- Research Trends in Physiology and Related Fields in Central Germany and West Berlin
ONRL 56-62	"	- Notes on Research in Physiology and Related Fields at the University of Cambridge
ONRL 57-62	"	- Research Trends in Physiology and Correlative Fields in the Republic of Ireland
ONRL 73-62	"	- Research Perspectives in Physiology and Ancillary Areas in the Republics of the Lebanon and Israel
ONRL 89-62	J.R. Kingston	- Institut Pasteur de Brabant, Brussels
ONRL 90-62	"	- Prince Leopold Institute of Tropical Medicine
ONRL 91-62	"	- Centre de Transfusion-Reanimation de l'Armée, "Jean-Julliard," Clamart
ONRL 9-62	J.H. Stover	- Military Medicine in the Federal Republic of Germany, 1962
ONRL 34-62	E.A. Walsh	- The Bone and Tooth Society
ONRL 1-63	S.W. Handford	- Congress with Moscow
ONRL 8-63	"	- Notes on Research in Physiology and Related Fields in the Republic of Finland
ONRL 10-63	"	- Some Aspects of Research in the Biomedical Sciences at Caroline Institute, Stockholm, and the University of Gothenburg, Sweden
ONRL 14-63	"	- Medical Research in the Norwegian Defence Establishment
ONRL 23-63	"	- Some Current Aspects of Biomedical Research in Belgium
ONRL 41-63	"	- Some Aspects of Biomedical Research in Italy I. Rome and Florence
ONRL 42-63	"	- Some Aspects of Biomedical Research in Italy II. Pisa and Milan
ONRL 45-63	"	- Biomedical Research in the Federal Republic of Germany II. Frankfurt, Bad Nauheim, and Bonn
ONRL 56-63	"	- Notes on Research in Physiology and the Medical Tradition of Scotland

ONRL 57-63	S.W. Handford	- Biomedical Research in the Republic of France (With a Note on the National Organization for Scientific Research) I. Paris
ONRL 70-63	"	- Research and Physiology and Related Fields at the National Institute for Medical Research in the United Kingdom
ONRL 71-63	"	- Biomedical Research and Notes on Medical Education in Hungary
ONRL 74-63	"	- Biomedical Research in the Republic of Austria I. Vienna
ONRL 78-63	"	- Research in Progress at the Royal Naval Physiological Laboratory
ONRL 79-63	"	- Biomedical Research in the Federal Republic of Germany III. Munich
ONRL 63-63	J.R. Kingston	- Notes on Military Medical Research in France
ONRL 3-63	E.A. Walsh	- Dental Caries Research in Britain
ONRL 1-64	J.R. Kingston	- Medical Evacuation Exercise of the German Navy
ONRL 36-64	"	- Further Notes on Military Medical Research in France
ONRL 56-64	"	- Biomedical Research in Egypt or Ten Years After
ONRL 59-64	"	- Organization of Military Medical Research in Sweden
ONRL 60-64	"	- Naval Medical Research Unit No. 3, Cairo, U.A.R.
ONRL 10-64	S.W. Handford	- Research in Physiology and Closely Related Sciences in the Republic of Portugal
ONRL 11-64	"	- Research in the Physiological Sciences in the State of Spain, with a note on Medical Education
ONRL 15-64	"	- Research in the Biomedical Sciences in Italy: III. Pavia, Parma and Modena
ONRL 21-64	"	- Research in the Biomedical Sciences in Italy: IV. Bologna, Ferrara and Padua
ONRL 39-64	"	- Biomedical Research in the Federal Republic of Germany: IV. Hamburg, Göttingen, Tübingen and Freiburg/Br.
ONRL 46-64	"	- Research in the Biomedical Sciences in the Republic of France: II. Marseilles, Montpellier and Lyons
ONRL 55-64	S.C. Dunn	- Notes on Certain Military Aviation Medical Activities in Europe, Part I
ONRL 31-65	E.P. Cooper	- Radiobiology in Great Britain
ONRL 12-65	C.E. Meyers	- The Department of Dental Science of the Royal College of Surgeons of England
ONRL 13-65	"	- Provision of Dental Treatment in England and Wales: An Address by Surgeon Rear Admiral Wm. Holgate, Chief Dental Officer, Ministry of Health
ONRL 22-65	C.H. Miller	- Tropical Medicine Research in the UK
ONRL 32-65	"	- Notes on Preventive Medicine in Germany
ONRL 46-65	"	- Institute of Naval Medicine, Kiel, Federal Republic of Germany
ONRL 51-65	E.A. Edelsack	- Some Biophysics Facilities in Sweden
ONRL 9-65	C.C. Klick	- Symposium on Personnel Dosimetry for External Radiation
ONRL 11-66	S.C. Dunn	- Notes on Certain Military Aviation Medical Activities in Europe. Part II
ONRL 53-66	I.N. Mensh	- A Note on Medical Education in Great Britain
ONRL 9-66	C.E. Meyers	- Dental Education in France and Switzerland
ONRL 22-66	C.H. Miller	- Notes on Naval Medicine in The Netherlands, Belgium and Denmark
ONRL 1-66	C.N. Peiss	- Some Aspects of Research in Physiology, Neurophysiology and Neuroanatomy at the University of Oslo, Norway
ONRL 13-66	"	- The Department of Physiology, University of Göteborg, Sweden
ONRL 17-66	"	- Notes on Medical Education and Physiological Research in the United Arab Republic (Egypt)
ONRL 31-66	"	- Some Aspects of Biomedical Research and Medical Education in Israel
ONRL 40-66	"	- Medical Education and Research in Spain

CHEMICAL SCIENCES

ONRL 20-62	G.J. Janz	- Electrochemical Research Programs: Cambridge, Liverpool, and London
ONRL 21-62	"	- Electrochemical Research Programs: London, Newcastle and Sheffield
ONRL 22-62	"	- Polymer Research at Six Centers in France, Germany and Switzerland
ONRL 23-62	"	- Fuel Cell Research at Two Centers near Paris
ONRL 37-62	"	- Electrochemical Research Programs at Stuttgart, Milan, and Padua
ONRL 41-62	"	- Institute of Industrial Chemistry, Univ. of Bologna, Italy
ONRL 42-62	"	- Institute di Quimica Fisica, Rocasolano, Madrid
ONRL 43-62	"	- Physical and Inorganic Chemistry in Belfast, Dublin, and Leicester
ONRL 49-62	"	- Physical, Inorganic, and Electrochemistry at Two Centers in Switzerland
ONRL 51-62	"	- High Temperature Chemistry at Saint-Gobain (Paris) and E.N.S. (Grenoble)
ONRL 52-62	"	- Max-Planck Institute for Physical Chemistry, Göttingen
ONRL 53-62	"	- Physical and Inorganic Chemistry at Four Centers in Italy
ONRL 59-62	"	- Physical and Inorganic Chemistry at Seven Centers in Germany
ONRL 77-62	M.J. Kamlet	- Organic Chemistry at Three Irish Universities: University College, Cork; Trinity College, Dublin; Queen's University, Belfast
ONRL 87-62	"	- Organic Chemistry in The Netherlands
ONRL 69-63	E.R. Anderton	- Chemistry at the British "Redbrick" Universities III. Pulp and Fiber Technology at Manchester (College of Science and Technology)
ONRL 25-63	J.H. Faull	- Elastomer Program Trends at European Research Institutes
ONRL 26-63	"	- Polymer Research Activity in Scandinavia
ONRL 27-63	"	- Basic Polymer Science at Some European Centers
ONRL 28-63	"	- Some Elastomer and Related Plastic Technological Research Activity in Europe
ONRL 11-63	M.J. Kamlet	- Organic Chemistry at the British "Redbrick" Universities. I. Exeter and Bristol in the Southwest
ONRL 22-63	"	- Organic Chemistry in the British "Redbrick" Universities. II. Liverpool
ONRL 33-63	"	- Organic Chemistry at the Weizmann Institute, Rehovot, Israel
ONRL 47-63	"	- Organic Chemistry at the Hebrew University, Jerusalem
ONRL 80-63	C. Klingsberg	- The Organization of the French Ceramic Society
ONRL 26-64	C. Klingsberg	- The National Institute of Glass, Belgium
ONRL 29-64	"	- The National Chemical Laboratory of Great Britain
ONRL 34-64	"	- The Department of Ceramics with Refractories Technology, University of Sheffield
ONRL 48-64	"	- The Department of Glass Technology of the University of Sheffield
ONRL 49-65	B. Bartocha	- The XXth Congress of the Int'l Union for Pure and Applied Chemistry in Moscow and a Post-Congress Tour to Usbeck Soviet Socialist Republic
ONRL 27-65	G.M. Corcos	- Aerodynamics and Combustion in Spain
ONRL 59-65	S.Y. Tyree	- Inorganic Chemistry in Scandinavia
ONRL 8-66	B. Bartocha	- Edward Davies Chemical Laboratory, University College of Wales, Aberystwyth
ONRL 12-66	S.Y. Tyree	- Some Inorganic Chemistry in France
ONRL 21-66	"	- Chemistry at Battersea
ONRL 24-66	"	- A Brief Survey of Academic Chemistry in Israel and Lebanon
ONRL 38-66	"	- Inorganic Chemistry in Italy

EARTH SCIENCES

ONRL 65-62	A.F. Richards	- Physical Geography and the Geomorphology Laboratory at Uppsala
ONRL 80-62	"	- Marine-orientated Geoscience in Tübingen, Göttingen, and Clausthal, Germany
ONRL 43-63	A.F. Richards	- Notes on the Hydraulics Research Station and Marine Geography, Geology, Geophysics and Meteorology in Britain
ONRL 64-63	A.L. Powell	- The Institute of Meteorology at the University of Stockholm, Sweden
ONRL 44-66	H.D. Hamilton	- Operational Guide to Synoptic Applications of Meteorological Observations

ELECTRONICS, MATHEMATICS, MECHANICS

ONRL 6-62	D.J. Angelakos	- Physics at the University of Thessaloniki, Greece
ONRL 7-62	"	- Electronics Research in Israel
ONRL 25-62	"	- Ionospheric Research in Greece
ONRL 40-62	"	- Semiconductor Device Electronics at Imperial College of Science and Technology, London
ONRL 47-62	"	- Electronics in Denmark
ONRL 54-62	"	- New Fields in Electrotechnics at Delft
ONRL 60-62	"	- Telecommunications Institute, Budapest, Hungary
ONRL 76-62	F.T. Ogilvie	- Ship Slamming and Supersonic Airfoil Flow
ONRL 30-62	A. Roshko	- Aerodynamic Research in Western Germany (Part I)
ONRL 48-62	"	- Training Center for Experimental Aerodynamics, Belgium
ONRL 50-62	"	- Aerodynamics and Fluid Mechanics in The Netherlands
ONRL 66-62	"	- Aerodynamic Research in Western Germany (Part II)
ONRL 68-62	"	- Fluid Mechanics in Scandinavia
ONRL 44-63	M.P. Gaffney	- "Arbeitstagung", 1963
ONRL 16-63	F.T. Ogilvie	- Ship Slamming and Supersonic Airfoil Flow
ONRL 50-63	"	- Laboratory for Inland-Ship Building, Duisburg
ONRL 55-63	"	- Ship Hydrodynamics in Western Germany
ONRL 72-63	"	- Fluid Mechanics Studies at the Technische Hochschule, Karlsruhe
ONRL 82-63	"	- Hydraulics and Free Surface Hydrodynamics at Grenoble
ONRL 12-63	B. Reinhart	- Recent Work of R. Thom
ONRL 2-64	G.H. Keitel	- Research Activities at the Radio Research Station, Slough, Bucks.
ONRL 9-64	"	- Some Electronics Research at the Royal Radar Establishment
ONRL 35-64	"	- Electromagnetics and Radioastronomy near Paris
ONRL 49-64	"	- Electromagnetics at the Universities of Birmingham, Edinburgh, Glasgow, Keele, Liverpool and Sheffield
ONRL 50-64	"	- Electromagnetics and Radioastronomy in Scandinavia
ONRL 14-64	M.P. Gaffney	- Homotopy and Duality
ONRL 8-65	G.M. Corcos	- Fluid Mechanics in England: Introduction and Part I
ONRL 24-65	"	- Fluid Mechanics in England: Part II, The Seventh British Theoretical Mechanics Colloquium 1965, Leeds
ONRL 27-65	"	- Aerodynamics and Combustion in Spain
ONRL 29-65	"	- Fluid Mechanics in Paris
ONRL 30-65	"	- Fluid Mechanics in England, Part III
ONRL 14-65	B. Epstein	- Mathematics in the Scottish Universities
ONRL 57-65	"	- Mathematics in Northern and Southern Ireland
ONRL 26-66	B. Epstein	- Mathematical Activities in Greece
ONRL 34-66	"	- Mathematical Activities in Israel
ONRL 20-66	M.W. Long	- Submillimeter Waves and Astrophysics at Queen Mary College
ONRL 29-66	"	- Microwave and Radar Research at Philips Research Labs, Eindhoven
ONRL 39-66	"	- Some Electromagnetic Research and Development in West Germany

ONRL 41-66	M.W. Long	- Some Programs on Millimeter and Submillimeter Wave Spectroscopy in Europe
ONRL 45-66	"	- Radar Research in the Netherlands
ONRL 57-66	"	- Studies in West Germany on Microwave Propagation and Scattering over Water

METALLURGY

ONRL 38-62	D.S. Lieberman	- Metallurgical Research at Liverpool
ONRL 27-62	N. Petch A.G. Quarrell G.V. Raynor C.R. Tottle	- The USSR System of Higher Education in Metallurgy
ONRL 2-63	D.S. Lieberman	- Some Metallurgical and Solid State Research in Stockholm
ONRL 19-63	"	- Some Metallurgical and Metal Physics Research at the Max Planck Institut für Metallforschung and the Technische Hochschule, Stuttgart, Germany
ONRL 46-63	"	- Some Physical Metallurgy and Solid State Physics Research in Israel
ONRL 17-64	W. Beck	- Metallurgical Research in Great Britain: I. National Engineering Laboratory and National Chemical Laboratory
ONRL 18-64	"	- Metallurgical Research in Great Britain: II. Battersea College of Technology, Fulmer Research Institute and Sir John Cass College
ONRL 20-64	"	- Metallurgical Research in Great Britain: III. Imperial College of Science, London, Royal College of Science and Technology, Glasgow, and The College of Aeronautics, Cranfield
ONRL 24-64	"	- Metallurgical Research in Great Britain: V. Nottingham University
ONRL 25-64	"	- Metallurgical Research in Great Britain: IV. Sheffield University
ONRL 37-64	"	- Metallurgical and Electrochemical Laboratories in Germany: Part I. Polytechnic Institute, Aachen
ONRL 38-64	"	- Metallurgical and Electrochemical Laboratories in Germany: Part II. Polytechnic Institute, Karlsruhe, Munich and Max Planck Institut für Eisenforschung, Düsseldorf
ONRL 40-64	"	- Metallurgy at MOL - Center for Nuclear Physics in Mol-Donk
ONRL 41-64	"	- National Aeronautical and Astronautical Research Institute, Amsterdam
ONRL 47-64	"	- Metallurgical Research in Great Britain: Part VI. Universities of Cambridge and Manchester
ONRL 53-64	"	- Metals Research Institute, Delft
ONRL 57-64	"	- Metallurgy and Electrochemistry in Italy
ONRL 62-64	"	- Metallurgical Research in Scandinavia: Part I. Sweden
ONRL 63-64	"	- Metallurgical Research in Scandinavia: Part II. Norway
ONRL 64-64	"	- Metallurgical Research in Scandinavia: Part III. Denmark and Finland
ONRL 66-64	"	- Metallurgical and Electrochemical Research in Berlin, Vienna and Geneva
ONRL 56-65	W.S. Pellini	- Research on Fatigue and Fracture of Steel at the Ship Structure Research Laboratory and the Metal Institute TNO, Delft, Netherlands
ONRL 43-66	J.B. Cohen	- Fundamental Research on Materials at the Atomic Energy Research Establishment, Harwell
ONRL 49-66	"	- Metallurgical Research at Technische Hochschule, Aachen, Germany
ONRL 55-66	"	- Some Research in Materials in Birmingham
ONRL 32-66	W.S. Pellini	- Applications of Fracture-Safe Design Concepts in the Development of Weldable Structural Steels in Europe

NUCLEAR PHYSICS

ONRL 46-62	J. Jauch	- Atomic Physics in Greece
ONRL 18-62	H.A. Sandmeier	- The Fast Breeder Reactor Project at the Institute of Neutron Physics and Reactor Engineering at the Nuclear Research Center, Karlsruhe, Germany
ONRL 24-62	"	- Project Vulcain, The Variable Moderation Ship Propulsion Reactor at Belgonucleaire, Brussels, Belgium
ONRL 26-62	"	- Non-Destructive Burn-Up Analysis of Irradiated Fuel Samples Containing U-235 and Pu-239 at the Belgian Nuclear Center, Mol. Belgium
ONRL 62-62	"	- Centre Nucleaire de Cadarache (France)
ONRL 71-62	"	- Nuclear Energy Centers in Italy: Casaccia, Bologna, and Nuclear Division of FIAT
ONRL 62-63	I. Estermann	- Experimental Physics in Hamburg
ONRL 66-63	"	- Experimental Physics at the Universities of Genoa, Milan, Pisa, and Turin
ONRL 67-63	"	- Experimental Physics in West Berlin I. The Fritz Haber Institut der Max Planck Gesellschaft
ONRL 73-63	"	- Experimental Physics in West Berlin II. The Technical University
ONRL 77-63	"	- Solid State Physics at the Centre d'Etudes Nucleaires in Grenoble
ONRL 76-63	N. Seeman	- Rutherford High Energy Laboratory -NIMROD- Period I Plans
ONRL 54-64	J.M. Jauch	- Democritos Revisited (Greek Atomic Research Today)
ONRL 8-64	N. Seeman	- High Energy Nuclear Physics at the University of Birmingham
ONRL 13-64	"	- High Energy Physics at Liverpool, Manchester and Leeds
ONRL 32-64	"	- High (and some Low) Energy Physics at the Universities of Glasgow, Edinburgh, Durham and the Dublin Institute of Advanced Studies
ONRL 52-64	"	- Some High and Low Energy Nuclear Physics in the Low Countries
ONRL 58-64	"	- High Energy Physics in Denmark, Norway and Sweden
ONRL 61-64	"	- Experimental High Energy Physics in Northern Italy: Part I, Turin, Milan and Padua
ONRL 65-64	"	- High Energy Physics in Northern Italy: Part II, Bologna, Florence and Rome
ONRL 60-65	J.G. Brennan	- Nuclear Physics Centers in Belgium and The Netherlands
ONRL 3-65	E.P. Cooper	- Nuclear Sciences in Austria
ONRL 35-65	"	- Facilities for Low- and Medium-Energy Nuclear Physics in Western Europe
ONRL 38-65	"	- Research Relevant to Nuclear Weapon Defense in Scandinavia
ONRL 39-65	"	- Nuclear Physics and Radiobiology at the Grenoble Nuclear Research Center
ONRL 2-66	J.G. Brennan	- Nuclear and High Energy Physics in Northern Italy, Nov. 1965
ONRL 23-66	"	- Nuclear Physics in Israel
ONRL 28-66	"	- Some Nuclear Research Centers in Denmark and Sweden
ONRL 30-66	"	- Nuclear Physics in England
ONRL 36-66	"	- Some Nuclear Centers in France, Germany, Switzerland and Italy
ONRL 42-66	J.W. Hemann	- European Nuclear Energy Agency: Its Functions and Background
ONRL 27-66	J.M. Jauch	- A Meson Factory in Switzerland

OCEAN SCIENCE & TECHNOLOGY

ONRL 86-62	E.C. Haderlie	- The Laboratory at the Marine Biological Association of the United Kingdom, Plymouth
ONRL 88-62	"	- Marine Biology in Provincial Universities in Southern England and Wales

ONRL 14-62	A.F. Richards	- Physical Marine Science in Liverpool
ONRL 15-62	"	- Marine Biology Station, University College of North Wales
ONRL 29-62	"	- Geological Oceanography in Five British Universities
ONRL 31-62	"	- Oblique-Angle Sonar for use in Biological and Geological Oceanography
ONRL-63-62	"	- Institute of Marine Science, Kiel
ONRL 64-62	"	- Marine Biological Laboratory, Copenhagen University
ONRL 70-62	"	- Senckenberg Research Institute for Marine Geology and Marine Biology, Wilhelmshaven
ONRL 81-62	"	- Marine Science in Denmark and Sweden
ONRL 83-62	"	- Marine Science in Norway
ONRL 28-62	W.C. Thompson	- Oceanography in Poland
ONRL 6-63	E.C. Haderlie	- Zoological Research in Swiss Universities with Notes on Fisheries and Limnology Research in Germany and Austria
ONRL 13-63	"	- Istituto Italiano di Idrobiologie
ONRL 15-63	"	- Fisheries Laboratory, Lowestoft
ONRL 17-63	"	- Marine Zoology at the University of London
ONRL 18-63	"	- The Dove Marine Laboratory, Cullercoats, and the Oceanograph c Laboratory, Edinburgh
ONRL 48-63	"	- Notes on Freshwater Biological Laboratories in Scotland and England
ONRL 49-63	"	- Marine Science in Scotland
ONRL 51-63	"	- Notes on Marine Biological Research in the Netherlands
ONRL 52-63	"	- Marine Biology and Limnology in Scandinavia
ONRL 30-63	E.C. Haderlie & A.F. Richards	- Marine Science in Greece
ONRL 34-63	"	- Marine Science in Lebanon
ONRL 34-63	"	- Marine Science in Turkey
ONRL 38-63	A.F. Richards	- Marine and Earth Sciences in Iceland
ONRL 58-63	"	- Notes on Oceanography in Paris
ONRL 59-63	"	- List of ONR London Reports in Limnology and Marine Science
ONRL 31-63	A.F. Richards & E.C. Haderlie	- Marine Science in the U.A.R. (Egypt)
ONRL 32-63	"	- Marine Science in Israel
ONRL 37-63	"	- National Institute of Oceanography
ONRL 65-63	A.L. Powell	- Institute of Marine Research, Helsinki, Finland
ONRL 28-64	J.E. Ayres	- Oceanographic Facilities of the Royal Hellenic Navy
ONRL 12-64	A.F. Richards	- Marine Geology at Kiel University
ONRL 22-64	"	- Oceanography at the Musee Oceanographique Monaco
ONRL 23-64	"	- Oceanography in Italy
ONRL 51-64	"	- Research Vessel METEOR

ONRL 6-65	L.E. Cronin	- The Mediterranean Association for Marine Biology and Oceanology
ONRL 10-65	"	- Marine Radiobiology in the Mediterranean Area
ONRL 20-65	"	- Marine Biological Research by the German Federal Research Board for Fisheries
ONRL 25-65	"	- Holland's New Center for Marine Research
ONRL 34-65	"	- Marine Sciences at the Marine Station of Endoume and Oceanographic Center, Marseille, France
ONRL 37-65	"	- Notes on Small Marine Research Vessels in Europe
ONRL 41-65	"	- Marine Biological Laboratories of the University of Paris at Roscoff, Banyuls-sur-Mer and Villefranche
ONRL 43-65	"	- Marine Science in Yugoslavia
ONRL 45-65	"	- The Oldest Marine Laboratory for Marine Biology, Concarneau, France
ONRL 62-65	"	- The Biological Institute of Helgoland
ONRL 14-66	N.W. Rakestraw	- Oceanography in France, Spain and Portugal
ONRL 15-66	"	- What the Chemists are Learning about the Ocean (Chemical Oceanography in Europe)
ONRL 19-66	"	- The Life and Activities of a Physical Oceanographer (John C. Swallow)

PHYSICAL SCIENCES

ONRL 55-62	D.J. Angelakos	- FOM - Institute for Plasma Physics, Jutphaas, The Netherlands
ONRL 58-62	J. de Launay	- Physics at Queen Mary College, London
ONRL 61-62	"	- Royal Radar Establishment: Cryogenics and Infrared Spectroscopy
ONRL 67-62	"	- Low Temperature Research at the Kammerlingh Onnes Laboratory
ONRL 10-62	I. Estermann and D.S. Lieberman	- The Berkeley Nuclear Laboratory of the Central Electricity Generating Board
ONRL 35-62	I. Estermann	- Physikalisch-Technische Bundesanstalt
ONRL 39-62	"	- Low Temperature Laboratory of the "Kommission für Tieftemperaturforschung der Bayrischen Akademie der Wissenschaften"
ONRL 85-62	"	- Experimental Physics in Several West-German Universities and Institutes of Technology
ONRL 33-62	H. Medwin	- Acoustics in West Germany - Part II
ONRL 45-62	"	- Acoustics in Southern France, Belgium, Italy and The Netherlands
ONRL 78-62	"	- Acoustical Activities in Northern France
ONRL 82-62	"	- Applied and Physical Acoustics at Imperial College of Science and Technology (London University)
ONRL 84-62	"	- Acoustics in the United Kingdom: Activities at Southampton and Glasgow Universities
ONRL 4-63	J. de Launay	- University of Reading Research in Radiation Damage and the Infrared
ONRL 9-63	"	- Grenoble: Some Research in Solid State Physics
ONRL 24-63	"	- Laboratoire de Mineralogie-Cristallographie (Paris) Solid State Research in Curien's Group
ONRL 39-63	"	- The University of Leeds: Solid State Physics
ONRL 40-63	"	- Ecole Normale Superieure I. Balkanski's Group on Semiconductors II. Kastler's Group on Radio-Frequency Spectroscopy
ONRL 60-63	R.E. Kagarise	- Optics and Spectroscopy in the London Area
ONRL 61-63	"	- Molecular Spectroscopy at the University Colleges of Swansea and Aberystwyth, Wales
ONRL 68-63	"	- Optics and Spectroscopy in Scotland
ONRL 75-63	"	- Spectroscopy and Optics in Brussels and Liege, Belgium
ONRL 81-63	"	- Optics and Spectroscopy in the Netherlands I. Amsterdam and Delft
ONRL 4-64	J. de Launay	- The Imperial College of Science and Technology - Solid State Research of I. Prof. M. Blackman, II. Dr. E.P. Wohlfarth
ONRL 30-64	"	- Solid State Physics at the Federal Institute of Technology, Zurich
ONRL 33-64	"	- National Physical Laboratory: Basic Physics Division
ONRL 7-64	I. Estermann	- The Franco-German Research Institute at Saint-Louis, France

ONRL 16-64	I. Estermann	- The Institute of Micro-calorimetry and Thermogenesis in Marseille
ONRL 27-64	"	- Physics at the University of Geneva
ONRL 3-64	R.E. Kagarise	- Optics and Spectroscopy in the North of England: Hull, Newcastle-upon-Tyne and Leeds
ONRL 6-64	"	- Optics and Spectroscopy in the London Area II
ONRL 19-64	"	- Optics and Spectroscopy in Freiburg and Stuttgart, Germany, and Zurich, Switzerland
ONRL 42-64	"	- Some Research Centers for Optics and Spectroscopy in Scandinavia. I. Norway
ONRL 43-64	"	- Some Research Centers for Optics and Spectroscopy in Scandinavia. II. Sweden
ONRL 44-64	"	- Some Research Centers for Optics and Spectroscopy in Scandinavia. III. Denmark
ONRL 45-64	"	- Optics and Spectroscopy in the London Area. III. Imperial College of Science and Technology
ONRL 5-64	E.L. Murphy	- MHD Electricity Generation Research at the Central Electricity Research Laboratories
ONRL 31-64	"	- Magnetohydrodynamic Research at Sheffield University
ONRL 17-65	I. Estermann	- Experimental Physics at Turkish Universities
ONRL 26-65	"	- Experimental Physics in Israel
ONRL 55-65	J.M. Jauch	- The International Center of Theoretical Physics in Trieste
ONRL 2-65	E.L. Murphy	- Direct Electricity Generation from Ionized Vapors and Flame (Calorelectric Experiments of S. Klein at Saclay)
ONRL 11-65	"	- The Franco-German Research Institute at Saint Louis, France
ONRL 28-65	"	- MHD Electrical Power Generation Research at the Electricité de France
ONRL 50-65	"	- Max-Planck-Institute for Physics and Astrophysics (Munich) and the Institute for Plasmaphysics (Garching near Munich)
ONRL 53-65	"	- MHD Research at the Institute for High Temperature Research (TH Stuttgart)
ONRL 5-65	D. Ross	- Acoustics Activities in the Southern Half of West Germany
ONRL 7-65	"	- Acoustics Activities in Italy
ONRL 16-65	"	- Acoustics in Belgium
ONRL 23-65	"	- Acoustics Activities in the Paris Area
ONRL 33-65	"	- Acoustics Activities in the Northern Half of West Germany
ONRL 36-65	"	- Acoustics Research at the University of Southampton
ONRL 40-65	"	- Acoustics in the Midlands and North England
ONRL 44-65	"	- Acoustics in Southern France
ONRL 52-65	B.O. Seraphin	- Some Solid State Research at the Royal Radar Establishment, Great Malvern
ONRL 61-65	"	- Materials Research at the Services Electronics Research Laboratory, Baldock
ONRL 54-65	E.H. Weinberg	- Lasers in the UK, Part I: The Royal Radar Establishment (RRE), Great Malvern
ONRL 58-65	"	- Lasers in the UK, Part II: Services Electronics Research Lab, Baldock
ONRL 42-65	J.N. Zemel	- Thin Film Research in France and Switzerland
ONRL 33-66	I. Estermann	- Experimental Physics in Israel. Part II. The Weizmann Institute of Science
ONRL 52-66	P.D. Maycock	- Services Electronics Research Laboratory, 21st Anniversary Open Days, 14, 17, 18 October 1966
ONRL 3-66	B.O. Seraphin	- Some Solid State Physics in Warsaw and Prague
ONRL 5-66	"	- Solid State Physics in Some Universities in Southern Germany
ONRL 37-66	"	- Solid State Physics in Scandinavia
ONRL 50-66	"	- Some Solid State Physics in the Paris Area
ONRL 54-66	"	- Some Solid State Physics in Basel, Freiburg and Strasbourg
ONRL 4-66	E.H. Weinberg	- Lasers in the UK - Part III, National Physical Laboratory
ONRL 10-66	"	- Lasers in the UK - Part IV, Some Government Laboratories, A Collection of Miscellany

PSYCHOLOGICAL SCIENCES

ONRL 79-62	J.T. Lanzetta	- Human Science Research on "User" Requirements in Buildings at the Building Research Station
ONRL 92-62	"	- Notes on Psychological and Sociological Research and Training in Denmark
ONRL 93-62	"	- The British Psychological Society's 1962 London Conference
ONRL 5-63	J.T. Lanzetta	- Psychological Research and Training at Two Sorbonne Centers
ONRL 20-63	"	- Research and Training in Psychology in the Netherlands
ONRL 21-63	"	- Notes on Psychology and the Social Sciences in Greece and Turkey
ONRL 29-63	"	- Notes on Psychology and Social Science Research in Israel
ONRL 53-63	"	- Psychological Training and Research in Italy
ONRL 54-63	"	- The Psychological Laboratory of the University of Stockholm
ONRL 63-65	J.A. Nagay	- Notes on Psychology in Austria
ONRL 15-65	J.E. Rasmussen	- Psychology in Denmark 1964, II. Danish National Association of Mental Health
ONRL 18-65	"	- Psychology in Denmark 1964, III. Military Psychology
ONRL 19-65	"	- Psychology in Denmark 1964, IV. The Danish Institute for Educational Research
ONRL 47-65	"	- Psychology in Greece and The Athenian Institute of Anthropos
ONRL 48-65	"	- NATO Science Committee Conference on Operational and Personnel Research in the Management of Manpower Systems, 17-20 August 1965
ONRL 4-65	"	- Psychology in Denmark 1964, I. Overview and Copenhagen University
ONRL 6-66	J. A. Nagay	- Programmed Instruction in Norway, Sweden and Denmark
ONRL 16-66	"	- Psychology and Biotechnology at the Max-Planck-Institut für Arbeitsphysiologie (Dortmund)
ONRL 18-66	"	- Programmed Instruction in Military Training in the NATO Nations
ONRL 7-66	J.E. Rasmussen	- Notes on Psychology at the University College of South Wales and Monmouthshire
ONRL 25-66	"	- Notes on Psychology at Queen's College, Dundee, Scotland
ONRL 35-66	"	- Notes on Psychological Training and Research in Yugoslavia
ONRL 46-66	"	- Psychiatry in the Norwegian Defense Forces
ONRL 47-66	"	- Notes on Psychology in Northern Ireland
ONRL 48-66	"	- Military Psychology in Norway
ONRL 51-66	"	- Psychology at the Technical University of Norway, Trondheim
ONRL 58-66	"	- Psychology at Göteborg, Sweden: The Institute of Psychology, The Institute of Education, The Psychotechnical Institute

MILITARY SCIENCES

ONRL 5-62	W.E. Ditch	- Air Cushion Vehicles in the United Kingdom
ONRL 13-62	A.F. Jaeger	- Review of European Space Development Plans
ONRL 1-65	J.J. Tyson and G.A. Patterson	- Flight Evaluation of Entwicklungsring Sud Hovering Rig, Manching, Germany
ONRL 56-66	H.L. Seligmiller	- Jet Engine Exhaust Smoke

SPACE

ONRL 7-63	R.E. Adler	- European Space Research

PARTIAL INDEX OF ESN, VOLUME 20, 1966

The following articles which appeared in ESN, Volume 20, 1966, describe research at a specific institution. These are included as a supplement to the foregoing Technical Report index as some places have not been covered in reports.

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY *(Corporate author)*

OFFICE OF NAVAL RESEARCH
BRANCH OFFICE LONDON, ENGLAND

2a. REPORT SECURITY CLASSIFICATION

2b. GROUP

3. REPORT TITLE

EUROPEAN SCIENTIFIC NOTES, Supplement 1967

4. DESCRIPTIVE NOTES *(Type of report and inclusive dates)*

N.A.

5. AUTHOR(S) *(Last name, first name, initial)*

Rasmussen, J.E. and Hewitson, Victoria, Ed.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
10 March 1967	28	

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
N.A.	ESN, Supplement 1967
b. PROJECT NO. N.A.	
c.	9b. OTHER REPORT NO(S) *(Any other numbers that may be assigned this report)*
d.	N.A.

10. AVAILABILITY/LIMITATION NOTICES This document is subject to special export controls; each transmittal to foreign governments or foreign nationals may be made only with prior approval of the Office of Naval Research Branch Office, Box 39, FPO, New York 09510.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
N.A.	N.A.

13. ABSTRACT

This is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to both American and European scientists by disclosing interesting information well in advance of the usual scientific publications.

The articles are written by members of the scientific staff of ONRL, with an occasional article contributed by a visiting stateside scientist.

DD FORM 1 JAN 64 1473

UNCLASSIFIED

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Biological Sciences Earth Sciences Electronics, Mathematics, Mechanics Metallurgy Nuclear Physics Physical Sciences Psychological Sciences Space Chemical Sciences						

INSTRUCTIONS

1. **ORIGINATING ACTIVITY:** Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. **REPORT SECURITY CLASSIFICATION:** Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. **GROUP:** Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. **REPORT TITLE:** Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. **DESCRIPTIVE NOTES:** If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. **AUTHOR(S):** Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. **REPORT DATE:** Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. **TOTAL NUMBER OF PAGES:** The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. **NUMBER OF REFERENCES:** Enter the total number of references cited in the report.

8a. **CONTRACT OR GRANT NUMBER:** If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. **PROJECT NUMBER:** Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. **ORIGINATOR'S REPORT NUMBER(S):** Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. **OTHER REPORT NUMBER(S):** If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. **AVAILABILITY/LIMITATION NOTICES:** Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through

_____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through

_____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through

_____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. **SUPPLEMENTARY NOTES:** Use for additional explanatory notes.

12. **SPONSORING MILITARY ACTIVITY:** Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. **ABSTRACT:** Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. **KEY WORDS:** Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, roles, and weights is optional.